The Electrical Industry's Weekly Magazine

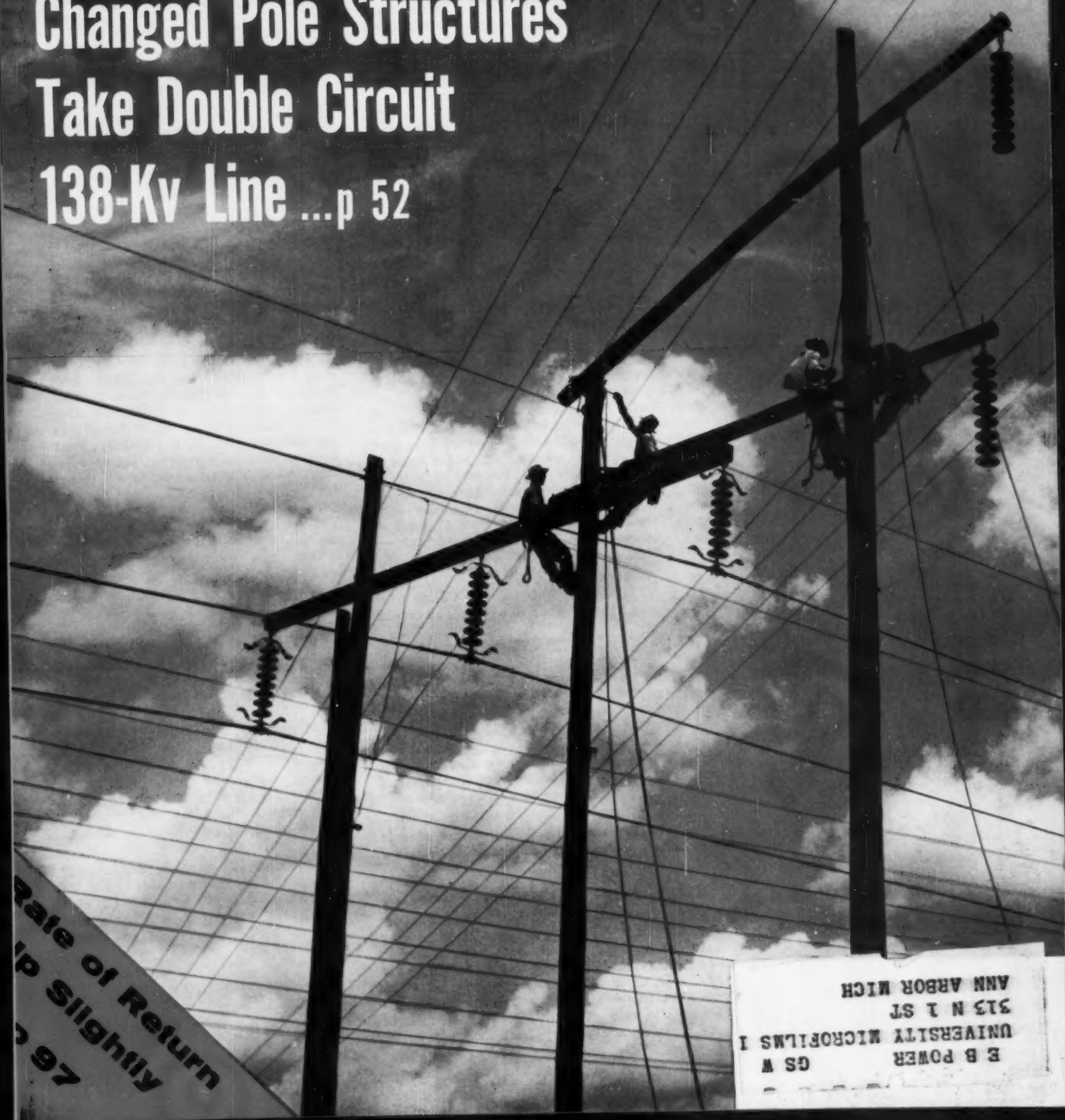
May 5, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Changed Pole Structures Take Double Circuit 138-Kv Line ...p 52



Rate of Return
Up Slightly
p 97

E S POWER GS W
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

Interview with General Electric's

WILBUR D. MARSH,

Application Engineer—

Why use gas turbines for peaking?

Q. Mr. Marsh, electric utilities have studied peak load generation in the past only to conclude, time and again, that peaking units were not economically justifiable. Have new gas turbine developments renewed interest in this subject?

A. Yes, but before looking at these, let's review the background. Electric utilities are discovering that conditions affecting the basic economics of peak load generation are changing. Look at it this way: a peak load unit must save enough in investment cost to more than offset its low efficiency. This effect—call it "production cost penalty"—is less for a peaking unit installed on a system *now* than it would have been in the past.

Q. How do you explain this change?

A. Despite its low efficiency, a peak load unit cannot have a very large effect on over-all system fuel consumption because it only operates a few hours each year. Deferring a new, efficient base load unit, however, has a much larger effect. Twenty years ago this effect was considerable because rapid progress made the steam cycle more efficient. Each new unit improved system average efficiency to a marked degree.

Q. I see. You couldn't afford to buy a peaking unit then because the best available steam turbine was so much better than your system as a whole.

A. That's right. But today many utility systems are relatively saturated with steam turbines nearly as efficient as latest units. Why? Because of rapid load growth and the fact that steam cycle efficiency gains are now much smaller and more difficult to achieve. Net result: the production cost penalty of deferring a base load unit (adding a peak load unit) is reduced considerably.

Q. What about the investment cost picture . . . is that changing?

A. Yes, in a sense it is. Utilities, consultants and suppliers like General Electric have always worked to keep station investment costs as low as possible. But in peak load generation it's permissible to sacrifice efficiency to get low investment cost, and this opens up new possibilities. For example, pumped storage hydro has received considerable attention recently. And, simpler forms of gas turbines have a real future in peak load applications.

Q. Which of these approaches is best for peak loads?

A. There is no pat answer. Each utility must consider its own special situation. Obviously, pumped storage hydro requires favorable terrain to be economical in first cost. As for gas turbine stations: I'd say that they promise much larger initial cost reductions but with correspondingly lower efficiency. This makes them most suitable for peak loads of short duration, and they might be combined with steam or pumped hydro in a kind of optimized peak load generating system.

Q. Aren't gas turbine sizes too small for utilities installing 150 or 200 megawatt units?

A. No. The basic simplicity of small gas turbines makes them low in first cost and also helps keep operating and maintenance costs *per kw* comparable to large size steam units. Also, the feasibility of unattended, remotely controlled stations makes several gas turbines no more of an operating problem than one large steam unit.

Q. Since gas turbines can't burn coal aren't they limited to natural gas areas?

A. Just as we sacrifice efficiency for low investment, we can also forego the ability to use low cost fuels. Peak load machines operate for very short periods, so in coal burning areas it's usually economical to use higher-cost distillate oils. Even if coal-burning gas turbines were available now it would be difficult to justify the added cost of coal handling equipment for peak load application.

Q. How about reliability? Are electric utilities inclined to invest in such a new prime mover?

A. First, let me say that utilities have never hesitated to try new equipment or new ideas if their studies show that they lead to reduced cost or better service. Now the gas turbine isn't new in the sense that it is untried. Over 135 General Electric units have chalked up 2¼ million hours of service since 1949 in a variety of applications.

Q. You've mentioned "production cost penalty" and investment cost saving which tends to offset it. Are there other cost factors, favorable or unfavorable?

A. No unfavorable ones in the usual peak load application. But added savings may exist in specific cases. For example, unattended stations can free skilled manpower for other important assignments. Placing gas turbines near load centers may reduce transmission investment . . . and losses. Gas turbines are more flexible as to location because they require little or no cooling water. The ability of gas turbines to start up, run for 3 or 4 hours, and shut down means higher average capacity factors on other generating units. This has a beneficial effect on over-all system fuel economy and maintenance costs.

Q. It sounds like many utilities could profitably explore the possibilities of gas turbines for peaking. How can they get more detailed information?

A. General Electric has experienced, competent engineering people who have worked on all types of peaking applications. These specialists can help a customer . . . or his engineering consultants work out the economic and technical aspects of a particular system addition.

For further information, contact your nearest G-E Apparatus Sales Office, or write for GER-1392 "Application of Gas Turbines for Peak Loads." General Electric Co., Section 301-385, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

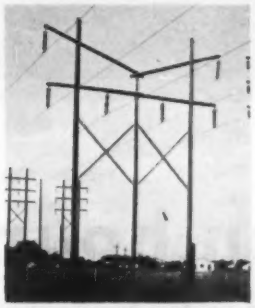
Electrical World

Vol. 149, No. 18 MAY 5, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

p 46



p 52

p 58

CURRENT EVENTS

Slurry Worry Nearly Over at Eastlake

Coal pipeline processing and drying problems are being ironed out. Commercial operation begins soon.....p 46

DISTRIBUTION

Silicon Rectifiers Solve DC Problem

A. F. Anderson and A. F. Corry, jr, Boston Edison Co

Four 250-kw submersible oil-cooled silicon rectifiers operate successfully on Boston Edison's dc network.....p 49

Regulator Design Checked on Analog Computer

H. L. Prescott, Westinghouse Electric Corp

Simulation of variations in step regulator characteristics will lead to optimum design.....p 56

RELAYING AND PROTECTION

Modified Audio Tone Improves Relaying

George W. Fox, Union Electric Co

Transfer-trip relaying is provided for three-terminal lines over circuits having 3,000-ohm loop resistance.....p 58

SUBSTATIONS

Boom and Platform Speed Jobs

Hydraulic unit saves $5,769 in five months for Indianapolis Power & Light Co. Means safe, fast movement of boom....p 70

TRANSMISSION

Add Circuit by Changing from H to K Frame

Refurbishing 20 structures to take additional 138-kv circuit was work of several days. Outage time: 8 hours.....p 52

Departments

Editorials 43
• Electrical Newsletter 11
Engineering Reference Sheet 74
Executive Reader 14
From the Publisher 5
How To 54
• Management Newsletter ... 97
Manufacturers News 78
New Equipment 86
News About People 104
Readers Forum 116
Sales Assignments 112
Selling 90

INDEX TO ADVERTISERS ..116

12kv giant goes under. San Diego Gas & Electric installed this 3,900-foot submarine cable across San Diego Bay in a fast and trouble-free operation. The new 12kv, 3/c, 500,000 CM cable is 4½ inches in diameter with Okolite rubber insulation, copper shielding tapes and steel armor.

Cable laying time: **half an hour flat!**

Okolite used for pre-tested dependability

The problem was to obtain maximum dependability in the new submarine cable laid under San Diego Bay to handle increased power needs in the busy Coronado area. In submarine cable, of course, dependability is doubly important with the rough service cable gets and the complicated and expensive operation required to lay a cable or remove it in case of trouble.

To insure this dependability, engineers from San Diego Gas and Electric chose pre-tested Okolite-insulated cable . . . and took advantage of three sound standards for evaluating anticipated cable service:

1. Time—High-voltage Okolite-insulated cables have a service record of more than 30 years . . . on land as well as in tough, underwater services, where a case of trouble can run into thousands of dollars.

2. Engineering—Okonite engineers' know-how pays off in every stage of cable purchase and installation: from designing the best construction possible to speeding installation, as in San Diego's case, with Okonite-designed reel frames, lifting beams and other cable-handling equipment.

3. Inch-by-Inch Inspection—Okonite now provides built-in life insurance for every strip-insulated, high-voltage cable through the use of its exclusive development, the "Gooding Test Train." This electronic testing equipment, which scans every inch of the cable, can pick out the most minute imperfection—impossible to detect by any standard test method—that might shorten cable life after it's placed in service.

These are three good reasons for *you* to specify Okolite for *your* vital high-voltage circuits. Whatever your cable needs, when you talk to Okonite, you get unprejudiced recommendations because Okonite, and *only* Okonite, makes cable by all four insulating methods: strip . . . dip . . . extrusion . . . taping. The Okonite Company, Passaic, New Jersey.

***where there's electrical power . . . there's* OKONITE CABLE**

5479

Playing the Old Record

Everyone who goes to the big electric utility industry meetings is now pretty well informed on the need for a fair rate of return on the investment devoted to supplying electric service. Most audiences have heard that selective selling to fill the valleys is the objective of all sales programs.

The people who go to power company meetings are also pretty well informed on the private versus public power controversy and related matters such as the preference clause and the 2% money which the co-ops seem to be able to draw upon indefinitely. Those who attend meetings of co-ops and municipals are well aware of the efforts of power companies to contain the federal, municipal, and co-op systems in their existing service areas and secure relief from the preference clause.

Are there not some new and imaginative ideas that can be discussed? Perhaps there is someone who would be willing to examine the weaknesses of the utility business. Why not set up a standard for some meeting that nothing can be repeated that has been said before? Such an approach would certainly make an interesting program. And it might reduce the number of words by an amazing percentage.

Fischer Black

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ABP **ELECTRICAL WORLD**

Vol. 149, No. 18 May 5, 1958

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for circulation regarding subscriptions or change of address.

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Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Title registered in U. S. Patent Office.

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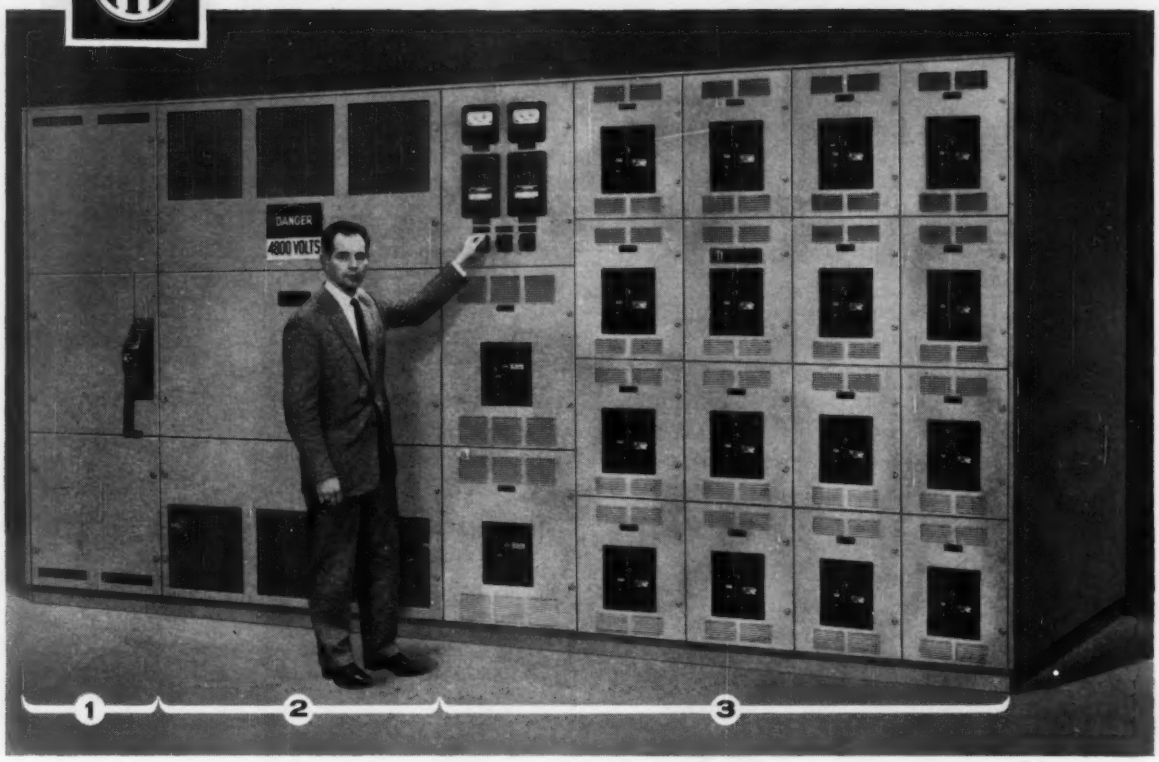
SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

SECONDARY UNIT SUBSTATIONS



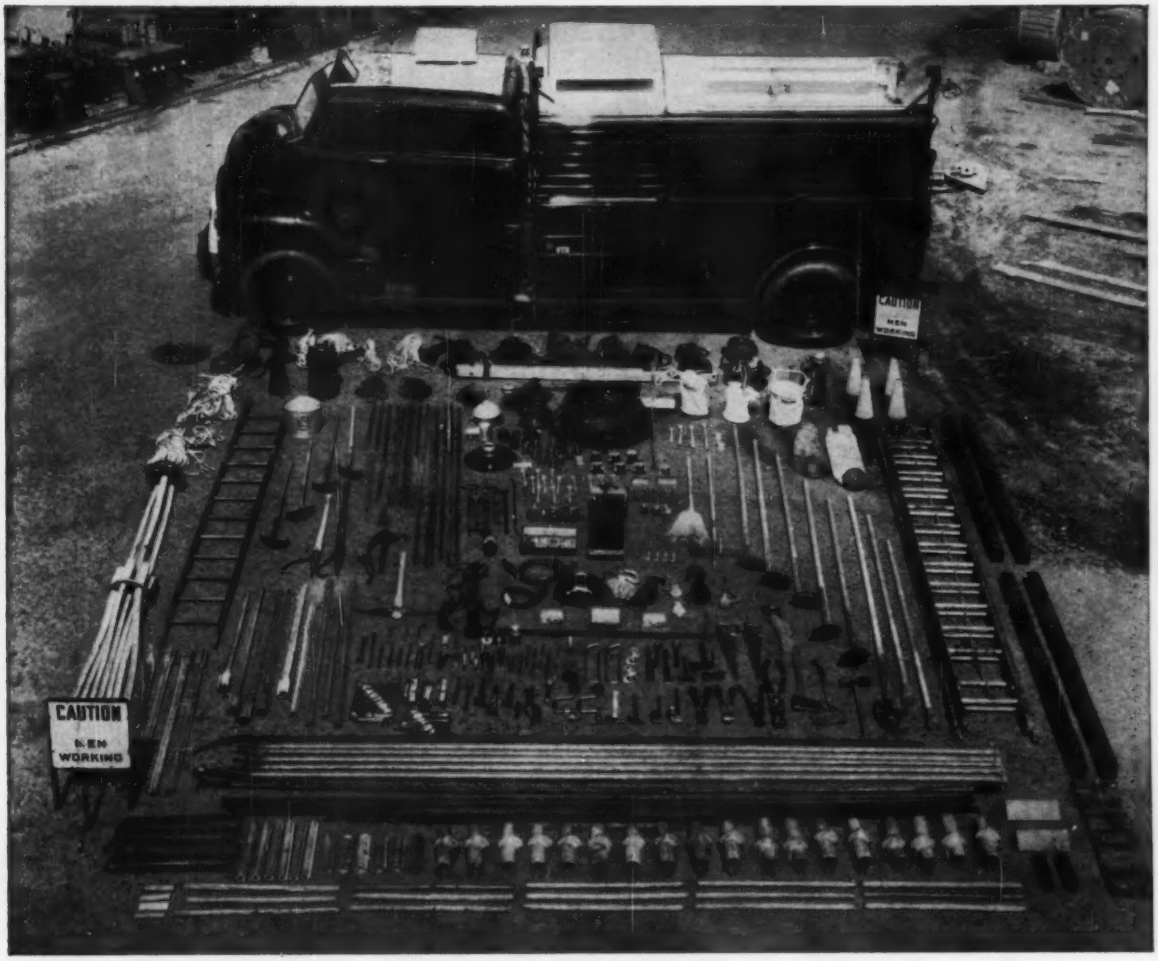
① **Incoming Section:** Terminal chambers; disconnecting and interrupter switches; roof bushing; metal-clad type HV/switchgear. ② **Transforming Section:** Askarel or oil-immersed type transformers; ventilated dry type transformers; sealed dry type transformers. All manufactured at I-T-E in Philadelphia. ③ **Outgoing Section:** The new K-Line of low voltage switchgear featuring manually charged or motor charged stored energy quick-make circuit breakers, and all with the closed door drawout feature.

I-T-E assumes all responsibility for your substation requirements

When you place an order for an I-T-E secondary unit substation, you can forget detailed planning, paperwork and the problems of coordinating delivery. I-T-E assumes complete responsibility. It engineers the unit to meet your requirements. It builds the transformers and switchgear. It assembles the complete unit under one roof, testing it to assure ease of installation and top performance. It ships the unit *as one package*, from one location, and ready to install.

Typical of the extra values found only in I-T-E secondary unit substations is the new quick-make K-Line of low voltage switchgear. A manually charged mechanism in each circuit breaker stores energy in the first 90% of pulldown handle travel, releases it in the last 10%. It also features racking to all positions—connected, test and disconnected—while doors are closed. Both features greatly increase operator safety and reduce maintenance problems. I-T-E secondary unit substations can be supplied for any application, indoor or outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila. 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ontario.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA • PENNSYLVANIA



Look at your line truck equipment needs from this angle . . .

Here's a poles-eye view of a typical utility line truck showing the wide variety of construction and maintenance tools and safety equipment your linesmen need for most day-to-day jobs. But—without exception—each and every item shown can be ordered conveniently from your nearby Graybar office or warehouse . . . and in every case you get the type and quality needed to assure speed and efficiency on the job *plus* long years of satisfactory service. All are products your linesmen know and respect—products that have been tried, tested and proven in the field by scores of companies just like your own.

Remember, when you order "via Graybar", you save the time and expense of multiple inquiries, for you can select, from this single source, the items best suited to your needs from among the products of over 200 of the nation's leading manufacturers.

Graybar is thoroughly familiar with utility requirements. Further, your nearby Graybar Representative stands ready to help as a convenient source of information on everything needed for pole-line construction and maintenance. And should you be faced with an out-of-the-ordinary problem, call on the experience of a Graybar Outside Construction Specialist for a consultation. We'll welcome your inquiry!

511

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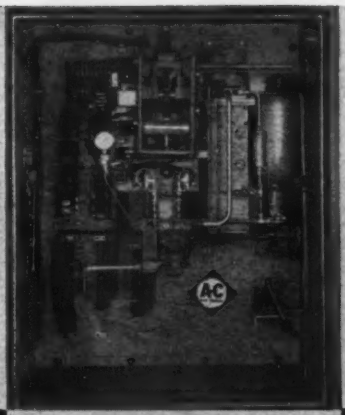
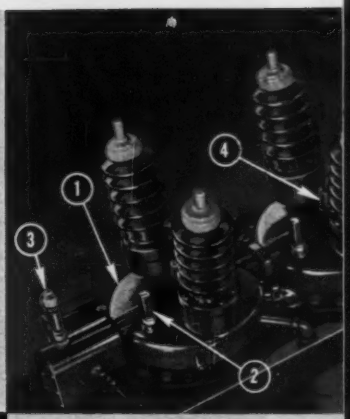
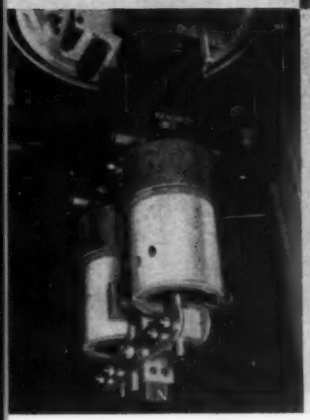
Few moving parts, fast action, freedom from problems of moisture, dust and dirt have resulted in reliability and wide acceptance of *Pneu-Draulic* operator.



(1) Self-cleaning, smooth, fabricated steel top for each tank; (2) high visibility float-type oil gauge and (3) position indicator; (4) external adjustment of overtravel stop (without using feeler gauges).





Positive contact — without contact bounce — is inherent in the *Turbo Ruptor* device with its tulip and bayonet-type contacts.

Time for raising and lowering tanks reduced 80% with power-operated hydraulic tank lifter — very little effort required. A 115/230-volt ac portable unit also available.

Pictures tell story of features of Allis-Chalmers large frame-type breakers

A-C ALLIS-CHALMERS

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CAREFUL engineering planning has resulted in today's top breaker value. There are big features: *Pneu-Draulic* operator; optional, power-operated hydraulic tank lifter; and tulip and bayonet-type *Turbo Ruptor* interrupting device.

... and still more features: side trip; ball-type position indicator visible from greater distance; wide, shallow and easily accessible operator cabinet; leak-free, float-type oil gauge; single lift-rod guide (instead of two) for accessibility; and many more.

These breakers are mechanically trip-free, as are all Allis-Chalmers breakers. They have AEIC standard wiring plus ASA standardized bushings.

For details, contact your nearby A-C office or write for Bulletin 71B8475. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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Every type of industry can profit from Dowell methods of chemical cleaning. Ask your maintenance and operating engineers if they have all the facts—the profit possibilities—on Dowell service. DOWELL INCORPORATED—A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma; 165 offices and stations to serve you.

Chemical cleaning services for industry DOWELL

The Electrical Newsletter

FUTURE NEWS ▶ **Britain's reported atomic program slowdown may help blunt Congressional demands for "crash" program of A-power development in U. S. British recently issued "white paper," indicating its goal of six million kw of A-power by 1965 may be put off a year, in view of plans to install more coal-fired generating capacity.**

FPC Commissioner S. L. Digby will retire at term's end, in June.

LATE NEWS ▶ **GE pledges full support to new federal task force to study impact on national security of imports of heavy electric apparatus (p 78).**

Utilities are still trimming inventories, but at a reduced rate. This was disclosed at recent EEI purchasing and stores group meet.

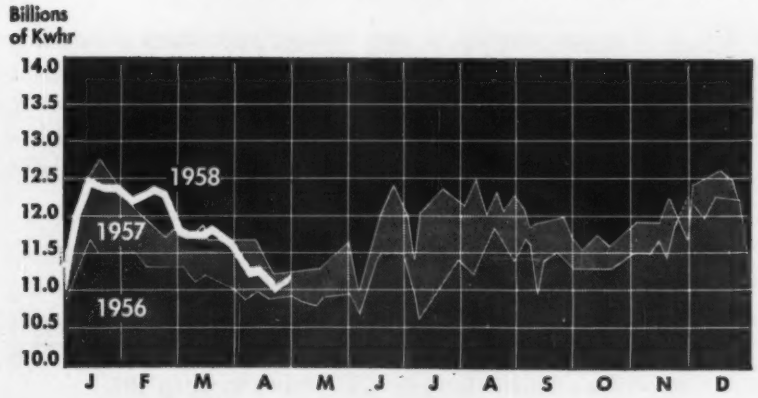
From Southeast: VEPCO and IBEW agree to a 5% wage boost . . . Alabama Power breaks ground for 75-Mw, $30-million Weiss Dam . . . AEC okays plans of Carolina-Virginia Nuclear Power Associates for $30-million nuclear plant at Parr Shoals. Next step: Negotiations of a pact for 19-Mw plant under third round demonstration program.

Connecticut L&P finally wins right to build Manresa Is. generating plant. Norwalk's shoreline residents had fought the move 5½ years.

Cincinnati G&E asks PUC okay to up rates $2,238,091/yr . . . Another $535,294/yr hike will be sought later . . . BPA may up basic rate of $17.50 per kw/yr in new five-year rate period starting Dec. 1959 . . . Elizabethtown (Tenn.) Electric cuts rates about $103,000/yr.

Management changes . . . PS of Indiana; R. A. Gallagher to chairman-chief executive; E. W. Hebel to president; D. P. Pardee to exec VP; E. H. Conway, Robert McMurray, J. J. Trainor to VP . . . PS of Colorado; M. M. Koch, R. T. Person to exec VP; D. J. Miller, O. P. Reed to VP . . . PS of Oklahoma; Wright Canfield to exec VP, G. I. Page to VP.

POWER OUTPUT—Down 0.9% (Week ending April 26, Kwhr 11,206,000,000



Per Cent Change From Previous Year

	Apr 12	Apr 19	Apr 26
Total U.S.	−3.3	−3.3	−0.9
New Eng.	+0.6	+1.3	+1.8
Mid. Atlantic ..	−2.5	−2.3	+0.1
Cent. Ind.	−6.0	−6.2	−4.0
West Cent. ...	−1.0	−0.6	+2.7
Southeast	−1.2	−1.6	−0.5
South Cent. ...	+0.2	−1.4	+0.5
Rocky Mount...	−0.7	−0.8	+2.1
Pacific			
NW	−6.4	−8.1	−5.9
SW	−7.5	+3.9	+3.3

Seasonally Adjusted Index 223.9

Week Ago 219.2 Year Ago 225.6

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, output decrease was 0.3%.

EVENTS ▶ **To what extent are utilities cooperating in "Buy Now" campaigns?** In the few areas really affected by the recession, they're backing the drives and stepped-up area development, shows an EW roundup. But most utilities aren't participating—mainly because economic conditions in most regions were reported as rather good. Meanwhile, PIP proposes an eight-point plan to tie in with Advertising Council's "Confidence in a Growing America" promotion (p 44).

CEI's worries over pipeline slurry are ending. With almost all problems ironed out, the utility will soon start receiving fuel from Cadiz, Ohio, coal mines via the world's first cross-country coal pipeline. Complete story starts on p 46.

MANAGEMENT ▶ **Rates of return are substantially higher under "fair value" jurisdictions,** a study of 103 power companies reveals. Average rate for all companies rose to 5.71% in 1957, while "fair value" companies reached 6.25%. For the rest of the story turn to p 97.

MEETING ▶ **Utilities must pursue two main goals**—dependable atomic power and lower costs generally. This advise, from AG&E's Philip Sporn, highlighted a diversified program at the recent Southeastern Electric Exchange meeting. Other features of the conference ranged from predictions for the future of A-power, coal, and higher secondary distribution voltages, to utility financing (p 102).

SUBSTATIONS ▶ **There's a new and easy way of moving 138-kv oil circuit breakers.** The method, which saves both time and overall costs by eliminating most dismantling and extra work involved in reassembling, is described step-by-step on p 54.

A hydraulic boom and aerial platform are proving invaluable to Indianapolis P&L in speeding up substations work. The equipment, which saved the utility about $5,769 in five months, features precision control for safe and fast movement of the boom. It can also be retracted or extended quickly and easily (p 72).

DISTRIBUTION ▶ **The day of optimum design of step voltage regulators is nearing,** thanks to the new information gained from modern analog computer techniques. By accurately simulating the step regulator, the computers are now performing a task once considered almost impossible—that of explaining how variations in characteristics can affect regulator performance (p 56).

Silicon rectifiers have proved to be the best solution to a dc problem on the Boston Edison system. The utility chose four space-saving 250-kw submersible oil-cooled silicon rectifiers as the most practicable and economical method of picking up 1,000 kw of its dc load. This installation freed a dc substation for conversion to ac (p 49).

You can prevent the hazards of static discharge and the more serious injuries resulting from it. For four helpful precautionary measures see **p 54.**

TRANSMISSION ▸ **Want to cut outage time when double-circuiting a line?** Through advance planning, Gulf States Utilities kept outage time to eight hours recently when it made big changes in a 138-kv line. This refurbishing involved switching 20 pole structures from H-type to K-type. You may find their tips helpful (p 52).

RELAYING ▸ **Pilot wire relaying helps Union Electric** gain audio-tone transfer-trip relay protection for a three-terminal 138-kv line. This new microwave accessory equipment, which is fully transistorized, offers many advantages: Less false tripping from noise, less susceptibility to limitations of circuit constants, and supervision of guard and trip signals (p 58).

SELLING ▸ **An electric heat campaign that can only be described in superlatives** wins 1,929 new installations for Washington Water Power in one year. The drive, which exceeded estimates by 365%, was based on a strong eight-point promotional program. WWP netted 16,400 installed kw for new residential customers, 6,626 kw for new commercial (p 90).

MANUFACTURERS ▸ **Power equipment manufacturers are hitting hard** against federal policy of buying major electrical equipment abroad. Strong protests have recently come from Allis-Chalmers' Willis G. Scholl and from Ralph L. Jenner and Brent Mills of Lapp Insulator. Meanwhile, ODM has moved to investigate GE assertions that the governmental purchases impair national security (p 78).

Mobile substations are getting bigger. The latest, a 15,000-kva, 64,400-v Transmobile, has just been completed by McGraw Edison's Pennsylvania Transformer Division (p 81) . . . GE establishes the apparatus and industrial group under VP Arthur F. Vinson (p 82).

NEW EQUIPMENT ▸ **You can now obtain POC bushings** for use in high voltage transformers and breakers. They're offered in ratings of 92, 115, 138, and 161 kv . . . A new automatic oscillograph designed with power plant use in mind begins operating within 2 millisec after fault occurs . . . A "Tee-lighting" highway luminaire now on the market has uni-directional reflector design. Mounted parallel to the road, it raises light level without producing glare (p 86).

PEOPLE ▸ **Top executive posts at Houston L&P** go to W. A. Parish, who becomes board chairman-chief executive officer; T. H. Wharton, president; and P. H. Robinson, executive VP . . . VEPCO ups E. H. Will to executive committee chairman-vice chairman of the board; A. H. McDowell, Jr, to president . . . G. R. Parry becomes executive VP and R. E. Neidig, VP-chief engineer of Metropolitan Edison (p 104).

Aluminum windings are planned for transformers, both distribution and power. The coils are made up of alternate layers of foil or thin strip, interleaved with paper or Mylar, and may be coated with epoxy or polystyrene resins. Such coils have favorable cost and normally operate at lower temperatures than conventional coils. Immediate conversions have been made in power and distribution type transformers by at least two major manufacturers.—**Kaiser Aluminum News, Spring 1958.**

Internal self-purification of feedwater and condensate within the cycle by a scavenger demineralizer promises reduction in operating and maintenance costs and freedom from feedwater impurity problems.—**V. J. Calise, Combustion, March 1958.**

TECHNICAL NOTES

Encapsulation of switchgear devices in flame-retardant resins is being studied as a means of flame-proofing switchgear.

Heat of solar radiation can cut the current-carrying capacity of a blackened No. 4 ACSR conductor as much as 6%, or from 165 amp when shaded to 155 amp in the sun, according to ALCOA research.

Radio-influence voltages from point protrusions on the surface of twin conductors of an EHV transmission line depend on conductor surface gradients around the circumference. Because gradients can vary 20% around the circumference, a protrusion in one quadrant can produce RIV; in another, none.

Cracking of cable ducts on bridges, resulting from vibration, can be remedied by wrapping the duct in asphalt impregnated (tar) paper at each support.

FROM EDITORS IN THE FIELD

Plastic-coated steel has made its appearance in England. It can be worked and treated as ordinary sheet steel, while its outer surface retains the characteristics of PVC.

Radioactive iodine will be used to indicate flow of water in a cooling pond for a large thermal plant in Australia.

L-M 6-Foot 4-Lamp Fluorescent Units in the main shopping center of Lake Geneva, Wisconsin. Units are at a 30-foot mounting height, at 55- to 60-foot staggered intervals. Each of the four 100-watt lamps provides 5700 lumens—a total of 22,800 for the luminaire, giving an average maintained illumination of 2.00 foot-candles, compared to .13 foot-candles of the old-style upright luminaires.

Lake Geneva Installs L-M Fluorescents For Better Lighting, Better Shopping

DEAN VAN NESS
City Manager
Lake Geneva, Wisconsin

"One of the most forward steps this city has taken in a number of years," says Dean Van Ness, City Manager, about the new L-M fluorescent street lighting system, recently installed in the beautiful southern Wisconsin resort city of Lake Geneva.

"City officials and citizens are well pleased with the appearance—both day and night. The lighting is most effective," adds Manager Van Ness.

The beautiful White Way layout in this well known resort center was created in cooperation with the Wisconsin Power & Light Company. L-M 6-foot shallow 4-lamp luminaires are mounted on 6-foot davit arm aluminum poles with 30-foot light centers. Poles are staggered at 55- to 60-foot intervals. The system gives an average maintained illumination of 2.00 foot-candles on the street, compared to .13 foot-candles of the old-style upright luminaires.

L-M fluorescent lighting like Lake Geneva's offers several important advantages. (1) Good lighting increases nighttime in-town shopping. (2) Traffic accidents are reduced. (3) Petty thievery is cut substantially, or eliminated, in lighted areas. In addition, L-M fluorescents provide low operating and maintenance costs. The special design utilizes the greatest proportion of the light with practically no glare. And L-M's unique wiring feature makes installation easy, fast, and economical.

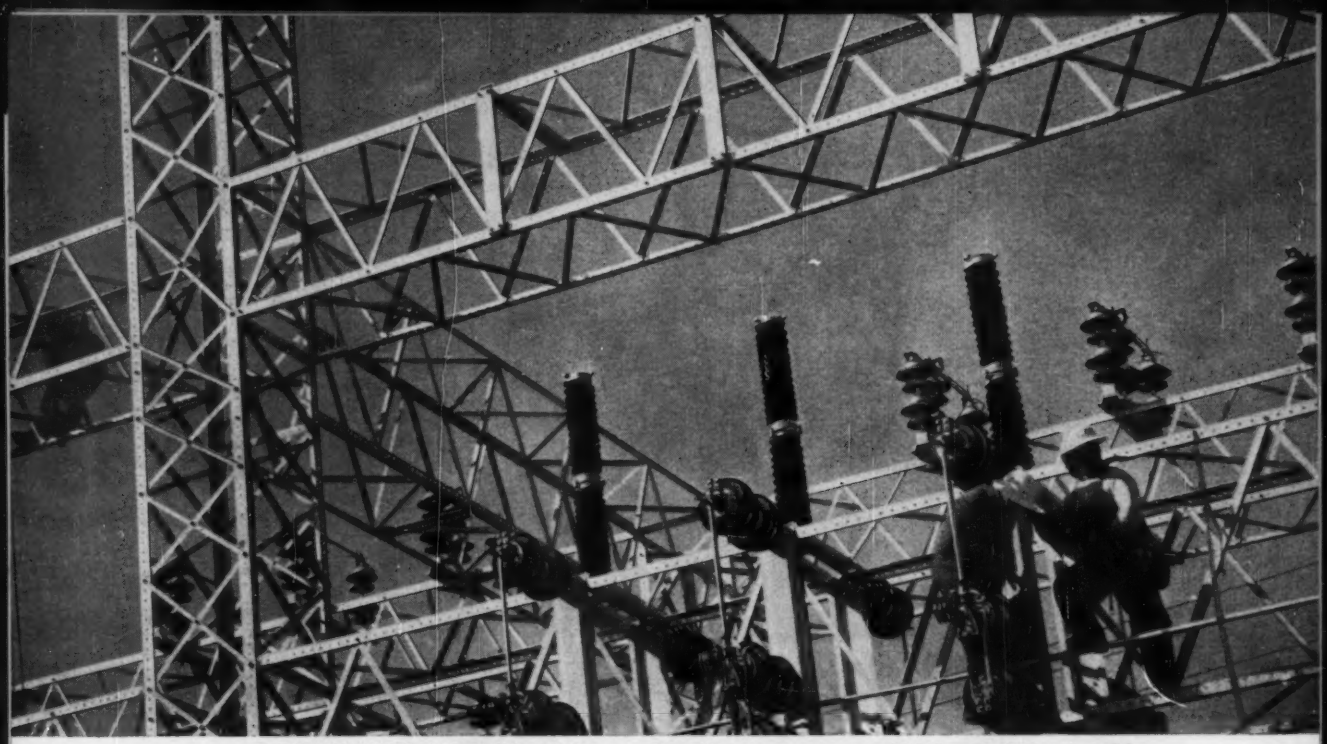
Ask for Bulletin

Ask the L-M Field Engineer or Lighting Specialist for information on L-M's lighting application engineering for streets, shopping centers, and airports, and for a free copy of bulletin on L-M fluorescent outdoor lighting. Or write Line Material Industries, Milwaukee 1, Wisconsin.

McGRAW EDISON

319 R2

LINE MATERIAL Industries Outdoor Lighting
McGRAW-EDISON COMPANY



THREE-PHASE INSTALLATION of L-M's new Ultra-Valve arresters, rated 60 kv maximum, in a 69 kv substation. The arresters are light and compact, and have outstanding electrical characteristics.

With Simple Series Gap and Valve Disc Design,

New Ultra-Valve Intermediate-Class Arrester Is Exceptionally Rugged, Durable, Light, Compact

Line Material engineers have developed a new, light, compact intermediate-class arrester that features rugged simplicity, exceptional durability and excellent protection.

These new Ultra-Valve arresters are easy to handle from receiving dock to job site, because they are decidedly lighter and more compact. Reduction in height has been achieved without a corresponding sacrifice in desirable external creepage distance, by providing a number of relatively deep skirts on the external housing surface.

The unusually rugged, simple construction minimizes the possibility of concealed damage caused by inadvertent rough handling in shipment or installation.

L-M's new Ultra-Valve arresters are capable of meeting the minimum discharge capacity and duty cycle tests for station-type arresters, as listed in ASA Standard C62.1-1957. These arresters provide excellent protective characteristics and are presently available in standard voltage ratings from 20 kv to 73 kv inclusive.

Ask your L-M Field Engineer for more information on how L-M's new Type F arrester can provide greater lightning and switching surge protection on your system. Or write Line Material Industries, Milwaukee 1, Wis. In Canada, Canadian Line Materials, Ltd., Toronto 13, Ontario.

Two-bolt terminals
Light-weight aluminum end-castings
Heavy compression spring
Ceramic resistor rings
Valve discs and spark gaps are alternated throughout the arrester

L-M's new Type F Ultra-Valve intermediate-class arrester is available in all standard ratings, 20 through 73 kv. 3 through 15 kv and 90 through 121 kv will be available soon.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Lightning Arresters

McGRAW EDISON

Why More Utilities Are Selecting L-M Type E Valve Arresters

L-M valve-type distribution lightning arresters have established an outstanding performance record by giving millions of service years of reliable protection. The Type E has been a leader in the field, and hundreds of thousands have been giving excellent service for many years. The failure rate is phenomenally low.

Here are some of the reasons for this remarkable record, and for the great increase in customer preference for the L-M Type E valve arrester.

Balanced Sparkover: Spark gap is a ladder-gap design, pre-set and then permanently sealed in the arrester housing. It cannot be knocked or burned out of adjustment. Gap is precision-made to assure optimum balance between 60-cycle sparkover and impulse sparkover.

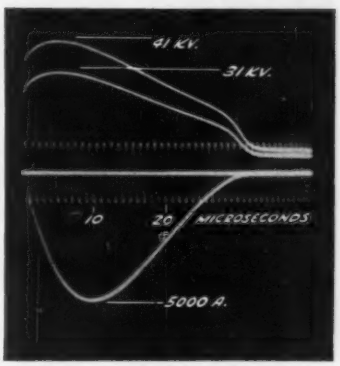
Low IR Drop: L-M now has a new Type E arrester, the E-3, which provides even lower IR drop than its popular predecessor. The new Type E-3 also provides greater durability and discharge capacity. These advantages are made possible because the new Type E-3 has an improved gap which provides greater 60-cycle interrupting ability, permitting reduction of the resistance of the valve element. The oscillogram shows the improvement in IR drop between the Type E and the new Type E-3.

Positive Protection: L-M valve arresters have a Pyrex glass housing which permits visual inspection of the spark gap in the field. Should the arrester become damaged, telltale evidence can be readily seen through the glass. If the arrester should fail to interrupt 60-cycle follow current for any reason whatsoever, L-M's patented Isolator provides positive assurance against grounding the feeder by disconnecting the ground lead from the arrester.

Other features include Zincilated (Zincilate No. 100) arrester housing clamp, fibre-glass cap, and fibre-form packaging. New packaging provides additional strength to the carton so arresters can be stacked easily on pallets.

Get Complete Information

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of bulletin on the new Type E-3 arrester, to Line Material Industries, Milwaukee 1, Wisconsin.



Oscillogram shows reduction in discharge voltage in the new Type E-3 valve-type lightning arrester. Curves are for a 9 kv unit. IR drop has been reduced from 41 kv to 31 kv—a remarkable improvement in a unit that already has established an enviable performance record over many years' service.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

LM Lightning Arresters

McGRAW EDISON

316

L-M's "HDO" open-type cutouts provide greater system reliability. The bird-proof design, rugged construction, and high interrupting capacity built into the cutout assure long, trouble-free service.

How L-M "HDO" Open-Type Cutouts Handle Both High and Low Faults

L-M's controlled double-venting principle provides positive pressure control—an outstanding advance in fuse cutout design.

by **M. L. FENNIG**
Sales Application Engineer,
Protective Equipment,
Line Material Industries

Fuse cutout design has always been something of a compromise. To assure expulsion of arcs from low-amperage faults, the tube must provide small volume to build ample pressure. Yet this same tube is subject to sudden rupture from the rapid development of large gas volumes from high-amperage arcs. L-M's controlled double-venting principle provides the best solution to this problem known at the present time.

Positive Pressure Control

A unique feature of L-M's "HDO" cutout is the pressure-controlled double-venting cap. On low-amperage faults, gases are vented from the bottom of the tube only. This allows sufficient pressure to build up in the tube to assure consistent, reliable arc interruption of faults of the smallest magnitude.

On high-amperage faults, where pressure relief is needed, the diaphragm in the heavy-duty cap opens at the top to allow double venting. The double venting reduces the stress on the cutout, eliminating the possibility of bursting the tube on high-amperage faults. This assures dependable operation, and greater safety for the lineman. Gases from the top are vented vertically to avoid gases from the bottom. This minimizes possibility of contact flashover.

L-M's "HDO" cutouts are strong, durable and easy to operate. They provide the greatest system reliability and lowest operating and maintenance cost of any cutout on the market today. Here's why.

Lower Resistance Path

All current-carrying parts are made of heavy-duty solid copper or copper alloy and are silver-plated to assure cool operation even after many years of service. In addition, the "HDO" has a minimum number of current-interchange points in the circuit, from line lead to the load lead. This provides ample capacity without overheating for years to come.

Greater Resistance to Corrosion

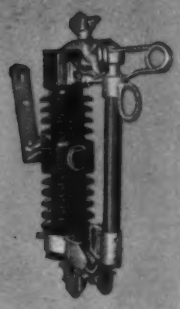
L-M uses high-strength, low-alloy corrosion-resistant steel, such as Cor-Ten, for all non-current-carrying parts, except the hanger. Cor-Ten steel has a yield point at least 1½ times that of structural steel and about twice that of mild carbon steel. Its ability to withstand atmospheric corrosion is 4 to 6 times greater than mild steel.

The results of a 16-year test, shown in the curves, prove the superior corrosion resistance of the low-alloy corrosion-resistant steel hardware furnished with L-M's "HDO" cutout.

Other Outstanding Features

- The "HDO" offers many other desirable features:
- Top contacts and center hanger mounting have through-bolts with insulated heads to provide complete bird-proof protection.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY



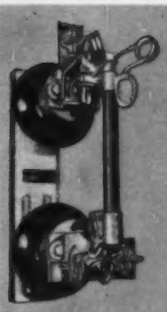
Distribution Class Single Insulator Type

L-M's standard mounting "HDO" cutouts are rugged, easy to operate with hook-stick. All current-carrying parts are silver-plated to assure cool operation.

Two Insulator Type

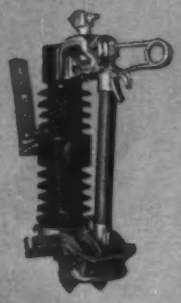
Distribution post insulator mounting of L-M's "HDO" cutouts provides additional creepage distance for applications in industrial and coastal areas.

Complete Line of Open-Type Cutouts from 5.2 kv to 27 kv



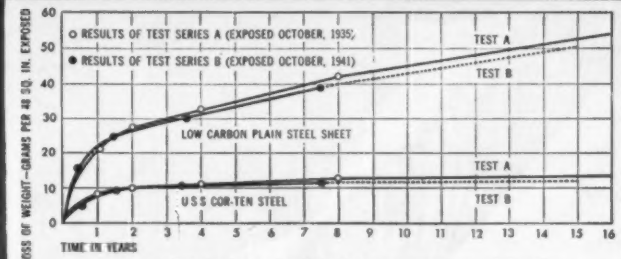
Power Class

Substation mounting is also available. L-M's "HDO" cutouts provide high interrupting capacity, economical fuse replacement, easy operation with a hook-stick and long life.



Load Break

Easy pulling action of interchangeable load-break cartridge will break the link. Arc interruption is completed inside the tube, assuring fast, safe switching of either inductive or capacitive load currents. Available in 5.2, 7.8, 15 and 27 kv ratings.


LOSS OF WEIGHT—GRAMS PER 48 SQ. IN. EXPOSED
TIME IN YEARS
○ RESULTS OF TEST SERIES A (EXPOSED OCTOBER, 1935)
● RESULTS OF TEST SERIES B (EXPOSED OCTOBER, 1941)
TEST A
TEST B
LOW CARBON PLAIN STEEL SHEET
TEST A
TEST B
U.S.S COR-TEN STEEL
0 10 20 30 40 50 60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Curves show that the loss of weight (rust penetration) of Cor-Ten high strength steel is one-fourth that of carbon steel and about one-third that of copper steel after 16 years exposure to *severe* industrial atmospheric conditions. Steel of this type is used for all non-current-carrying parts of the "HDO" except the hanger.

COR-TEN is a registered trademark of U. S. Steel Co.

SIZES AND RATINGS

Cartridges	Interrupting Capacities, Amperes 5.2 KV	7.8 KV	15 KV	27 KV
Normal-Duty Single Venting (Solid Cap)	3000 A.	3000 A.	2000 A.	1200 A.
Heavy-Duty Double Venting (Heavy-Duty Cap)	6000	6000	4000	4000
Heavy-Duty Single Venting (Solid Cap)	5000	5000	4000	
Extra-Heavy-Duty Double Venting (Heavy-Duty Cap)	10000	10000	8000	

- All cartridges are designed for easy hook-stick removal and replacement.
- Top contacts are husky, hard-drawn copper, silver-plated. They serve as guides so the tube cannot miss top contacts.
- Cartridge is firmly anchored; the tube cannot move upward, even when it is accidentally closed in on a fault, within its rating.
- Cutout interrupts any fault current, from minimum melting of link to maximum interrupting capacity of cutout, *with any size link.*

Complete Line of Cutouts

L-M offers a complete line of cutouts in 5.2, 7.8, 15 and 27 kv classes, with a full line of fuse cartridges in normal, heavy, and extra heavy-duty interrupting rating, switch blade, and interchangeable load-break cartridges. All cartridges (except the 27 kv) use standard 20-inch distribution fuse links.

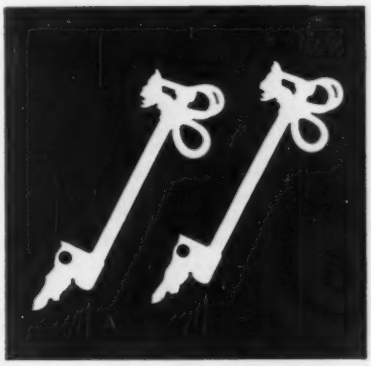
Interchangeable Load-Break Cartridge

Line Material's "HDO" open-type cutout has optional interchangeable load-break cartridges available in each voltage class and interrupting rating.

A pulling force of less than 30 pounds is required to break the largest size link. The cartridge is designed to interrupt all capacitive and inductive loads up through 100 amperes and to completely extinguish the load current in the tube. With L-M's simple load-break device you can switch loads or sectionalize distribution circuits quickly and easily with very little increase in your cutout investment.

Get Complete Information

Ask the L-M Field Engineer for bulletins and complete information about L-M's full line of open and enclosed fuse cutouts and other protective equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



How Double Venting Controls Pressure

On low-amperage faults, ample pressure is provided to insure fast arc extinction, by single venting at the bottom of tube, *A*.

On high-amperage faults, heavy-duty cap at top (*B*) opens so that pressure is vented at both top and bottom of tube, providing greater safety by eliminating tube rupture. Note that the gases from the top are vented vertically—not horizontally. This eliminates danger of contact flashover.

Field experience proves performance advantages of Preformed splices

In hundreds of thousands of applications, only one failure of a Preformed splice has been reported—and that was caused by inadequate preparation of a heavily corroded conductor.

This distinctive performance is the result of soundly engineered features: (1) uniform radial pressure of the splice rods; (2) full area of contact; (3) the flexibility of the rods which causes the grit particles to penetrate existing oxides and establish permanent electrical contact with the conductor; and (4) the inherent resiliency of the splice which maintains consistent surface contact with the conductor throughout extremes of line tension and temperature variation. These combined characteristics are your assurance of unfaltering mechanical and electrical performance at all times.

And, most important, no tools are needed to install a Preformed splice; the application is made entirely by hand and takes but a fraction of the time required for other types of splices.

There are Preformed splices to solve almost every splicing problem. They can be furnished to hold the full-rated strength of any standard transmission or distribution conductor.

Write for additional technical information. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

PLP

10 YEARS OF Power Line Progress

You can look up to **Preformed**

Made in accordance with or for use under U.S. Patent Nos. 2,609,653; 2,275,019; 2,587,521; and 2,691,685. Other patents pending.

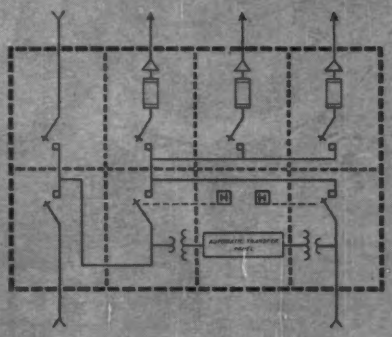
for high voltage service continuity on your critical loads at lower capital outlay— it's S&C Metalclad Switchgear!

To get service continuity on critical loads, you need preferred-to-emergency switching of your alternate incoming high-voltage supply circuits, and short-circuit protection and switching on your outgoing high-voltage supply feeders. All of this can be provided in one low-cost package in S&C Metalclad Switchgear, as illustrated.

You even have built-in choices of throwover schemes through S&C's standard automatic transfer panels.

You save two ways:

1. You get metalclad switchgear with job-matched load interrupters and power fuses, in lieu of costly circuit breakers.
2. You eliminate cost of custom designing by using an off-the-shelf transfer panel with built-in options.

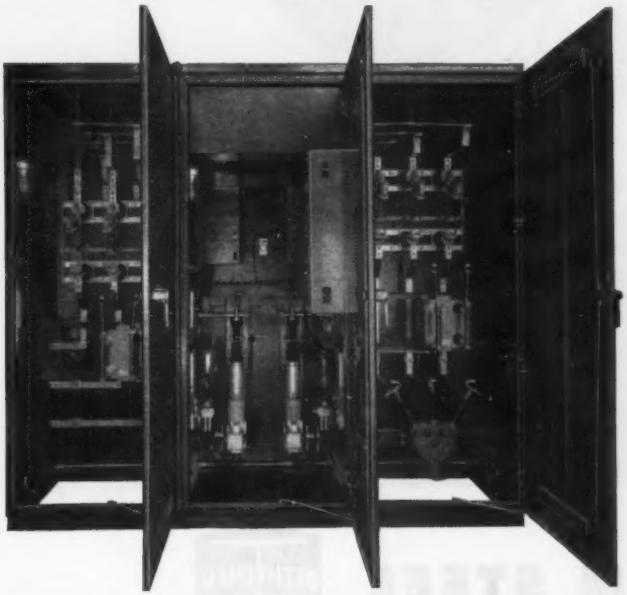


Schematic for 8-bay switching center unit (above) shows throwover control of 2 of 3 alternative incoming sources to provide continuous service for three outgoing feeders.

No organic insulation to cause corona trouble; porcelain and air only.

High-Speed Automatic Switching.

Full-length bulkhead doors; rainproof, with complete access.



Super Durabake finish with galvanized and stainless steel hardware; withstands corrosive atmospheres.

Separate compartment for Moto-Draulic operators; free access and decoupling for checkout.

Strip heaters with adequate venting prevents moisture accumulation.

S&C Standard Automatic Transfer Panel provides for making either source preferred, for automatic or manual return, for adjustable time delays, for choice of returning in either open or closed transition, and for optional lockout on bus faults.

Power Fuses
Tool Operated Disconnects
Open and Enclosed Cutouts
Fuse Links
"Loadbuster"
Load Interrupters
Metalclad Switchgear

S&C ELECTRIC COMPANY
4421 Ravenswood Ave., Chicago 40, Ill.

In Canada: S&C Electric Canada, Ltd.
8 Vansco Road, Toronto 14, Ontario

The bethanized coating on Bethlehem strand is a shield that retards corrosion for years.

It is so ductile—and so tightly locked to each wire—that checking, cracking, and peeling are all but eliminated. Moisture and fume-laden atmosphere cannot get through to the steel. That's why Bethlehem strand, the *fully protected* strand, is always a sound investment where extra-long service is required.

Bethanized coating is available in three different thicknesses—A, B, and C.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Eliminate testing

of molded current transformers

with Westinghouse

FREE CERTIFIED TEST RESULTS

you install...that's all!

Only Westinghouse gives you...

FREE CERTIFIED

You need never acceptance-test

TEST RESULTS

another molded current transformer

SAVE TIME AND MONEY . . .

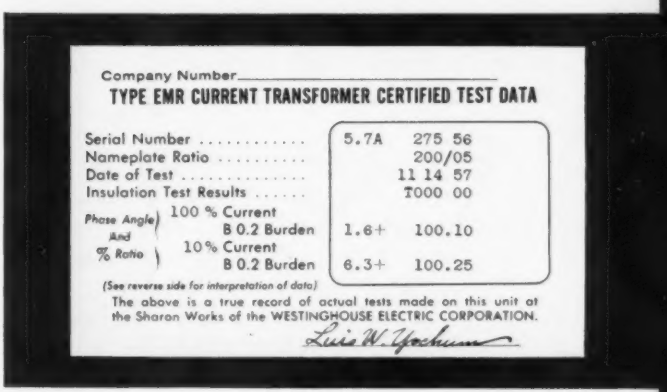
Westinghouse Certified Test Results mean that you need never *acceptance-test* another molded current transformer. This is because every Westinghouse molded current transformer is pretested *before* it is shipped. Further testing is completely eliminated . . . you install—that's all. In addition to saving time and money for you, Certified Test Results are your guarantee that when you install Westinghouse molded current transformers, you install top quality.

Westinghouse — and only Westinghouse — gives you Certified Test Results on its complete line of molded current transformers.

FOR YOUR FILES . . .

You receive for your files a 3 x 5 file card with the specific test data on every molded current transformer you purchase. This, again, eliminates another step for you when you buy Westinghouse molded current transformers.

These Certified Test Results should satisfy your state PUC requirements.



Company Number_____

TYPE EMR CURRENT TRANSFORMER CERTIFIED TEST DATA

Serial Number		5.7A	275 56
Nameplate Ratio			200/05
Date of Test			11 14 57
Insulation Test Results			T000 00
Phase Angle And % Ratio	100 % Current B 0.2 Burden	1.6+	100.10
	10% Current B 0.2 Burden	6.3+	100.25

(See reverse side for interpretation of data)

The above is a true record of actual tests made on this unit at the Sharon Works of the WESTINGHOUSE ELECTRIC CORPORATION.

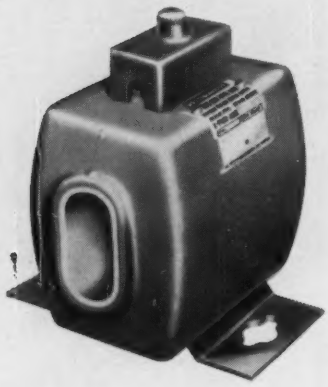
Luis W. Yochum

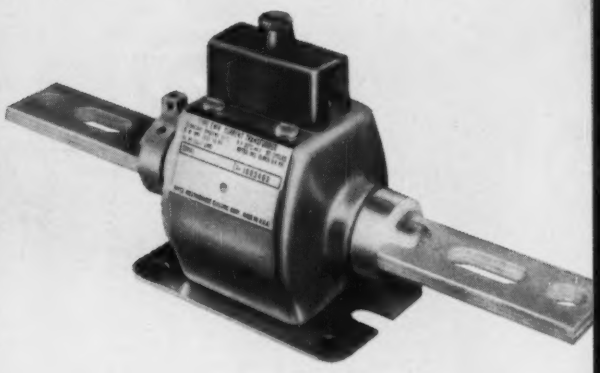
Molded current transformers being tested on the new Westinghouse automatic test installation at Sharon, Pennsylvania. Here is another example of Westinghouse plowing back earnings into development . . . saving you time and money by eliminating testing.

YOU CAN BE SURE...IF IT'S Westinghouse

THEY ALL HAVE IT . . .

All Westinghouse molded current transformers carry the Certified Test Results record. This includes the SM line, molded of silicone rubber, and the 600-volt class, molded of polyester elastomer, a product of Westinghouse research.





The EMO and EMR 600-volt class transformers are four ways superior to any comparable units:

- 50% greater cable capacity—with obround primary opening on the EMO.
- Positive, permanent connections—exclusive Ilsco-type secondary terminals with weatherproof covers.
- Longer life—polyester gives outstanding protection against weather and corrosive acid or alkali fumes, as well as outstanding resistance to deterioration caused by oil.
- Smaller, lighter—polyester molding, plus the new design, gives you reduced size and weight . . . simplifying installation.

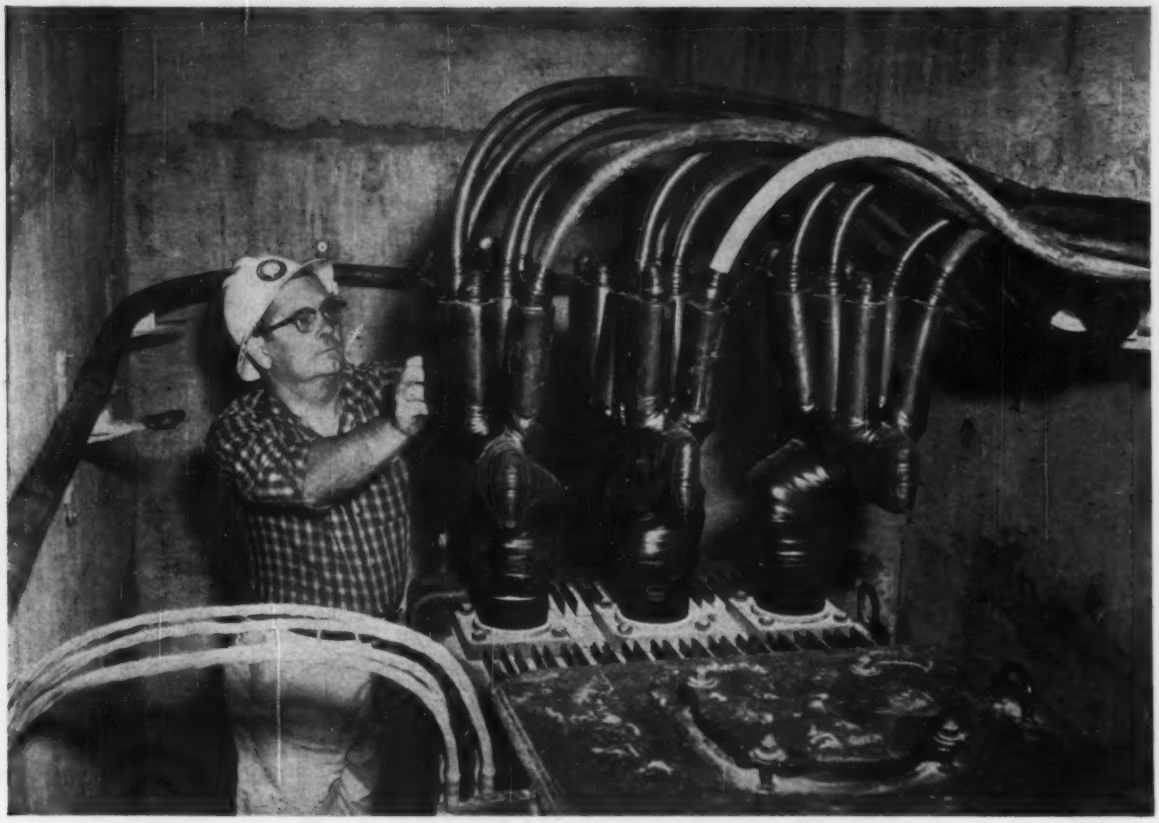
REMEMBER . . .

- You eliminate all testing of these transformers when you buy Westinghouse.
- You receive specific test data about the molded current transformers you purchase from Westinghouse, at no extra cost.
- You install—that's all—when you purchase Westinghouse molded current transformers.
- You receive . . . on the EMO and EMR current transformers . . . four extra features of superiority.

For full details on Certified Test Results call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

JI-70833-4

YOU CAN BE SURE...IF IT'S Westinghouse



Appalachian Electric Power Company protects Charleston network with neoprene

All cables and connectors on the Charleston, West Virginia, network are protected with neoprene. Neoprene jackets prevent corrosion of sheaths on 15 Kv paper and lead cables, and have often prevented damage to the lead during reel handling and in pulling operations. All rubber-insulated secondary cable is also jacketed with neoprene.

Secondary load connectors—as many as thirty 500 MCM copper conductors per phase—are covered with neoprene tape which cures into a moisture-proof mass. This tape protects all secondary cable splices as well, on overhead structures and in manholes and vaults (illustrated above).

Installations like this demonstrate neoprene's wide acceptance among distribution engineers. No other jacketing material so effectively resists ozone, sunlight and weather, oils and chemicals, heat, flex cracking, abrasion, oxidation and aging.

Ask your wire and cable suppliers about neoprene. And mail the coupon below to receive regular free copies of the ELASTOMERS NOTEBOOK. This will give you actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT
REG. U.S. PAT. OFF.

Better things for better living
. . . through chemistry

NEOPRENE
— made by Du Pont for 25 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-5
Wilmington 98, Delaware

Please put my name on the mailing list for the Elastomers Notebook.

Name_____
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Firm_____
Address_____
City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

HERE'S A
SPECIAL ADVANTAGE
OF THE
LJUNGSTROM:®

high availability

These five basic factors assure you that the Ljungstrom Air Preheater will give exceptionally long periods of uninterrupted availability:

1. **UNIFORMLY HIGHER COLD-END METAL TEMPERATURES.** This minimizes the danger of local corrosion due to cold spots.

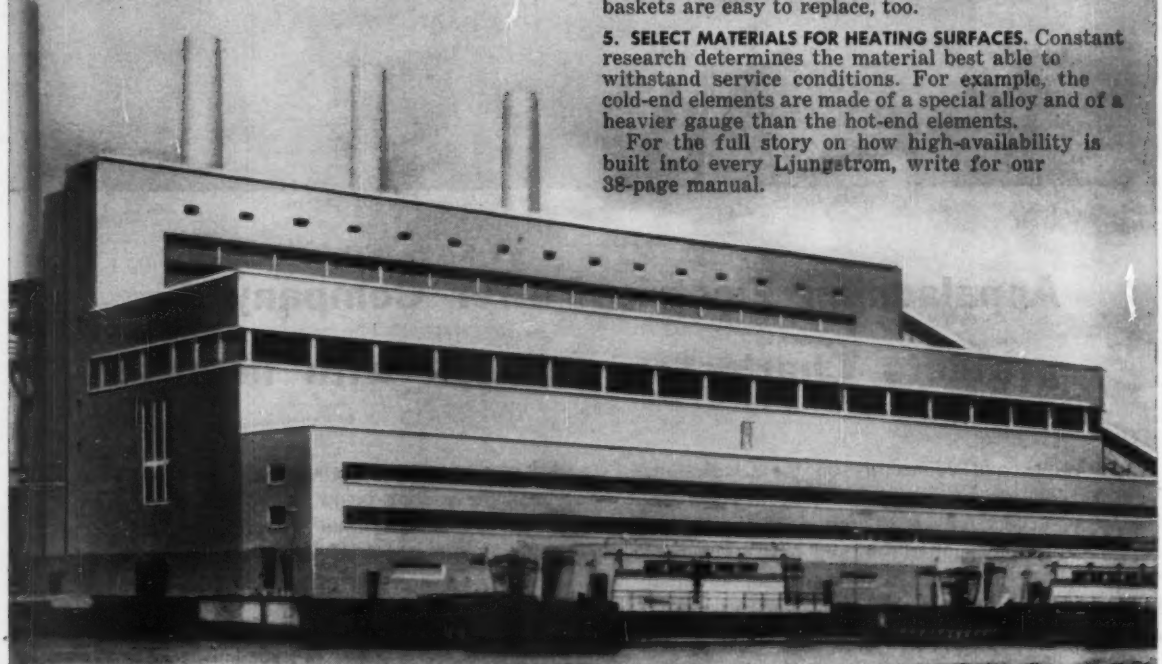
2. **POSITIVE CLEANING ACTION.** A mass-flow soot blower is normally installed at the cold end of the Ljungstrom where deposits are most apt to accumulate. Daily cleaning with superheated steam or compressed air removes any deposits.

3. **INSPECTION PORTS.** You can see for yourself, at any time, the condition of the heating surfaces.

4. **REVERSIBLE COLD-END BASKETS.** Elements in the cold end are separated into small baskets, which can be inverted when one end starts to wear thin. These baskets are easy to replace, too.

5. **SELECT MATERIALS FOR HEATING SURFACES.** Constant research determines the material best able to withstand service conditions. For example, the cold-end elements are made of a special alloy and of a heavier gauge than the hot-end elements.

For the full story on how high-availability is built into every Ljungstrom, write for our 38-page manual.



The Air Preheater Corporation 60 EAST 42nd STREET, NEW YORK 17, N. Y.

GET THE INSIDE STORY...

THIS NEW 8-PAGE BOOKLET TELLS WHY **ROEBLING TELLURIUM LEAD ALLOY SHEATH** LASTS LONGER!

90% less creep... 4½ times greater bending life... unusual stability under heat... negligible age-hardening—you've read how Roebling Tellurium Lead Alloy Cable Sheath has all these favorable, life-saving qualities, and more. Now the full story, complete with useful technical data, is told in an illustrated 8-page bulletin that's free for the asking.

Learn how cable maintenance problems can be materially reduced, with savings. Send for your copy of this informative book today!

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION
Electrical Wire Division
Trenton 2, New Jersey

Please send me your new Tellurium Lead Alloy Sheath Facts Book.

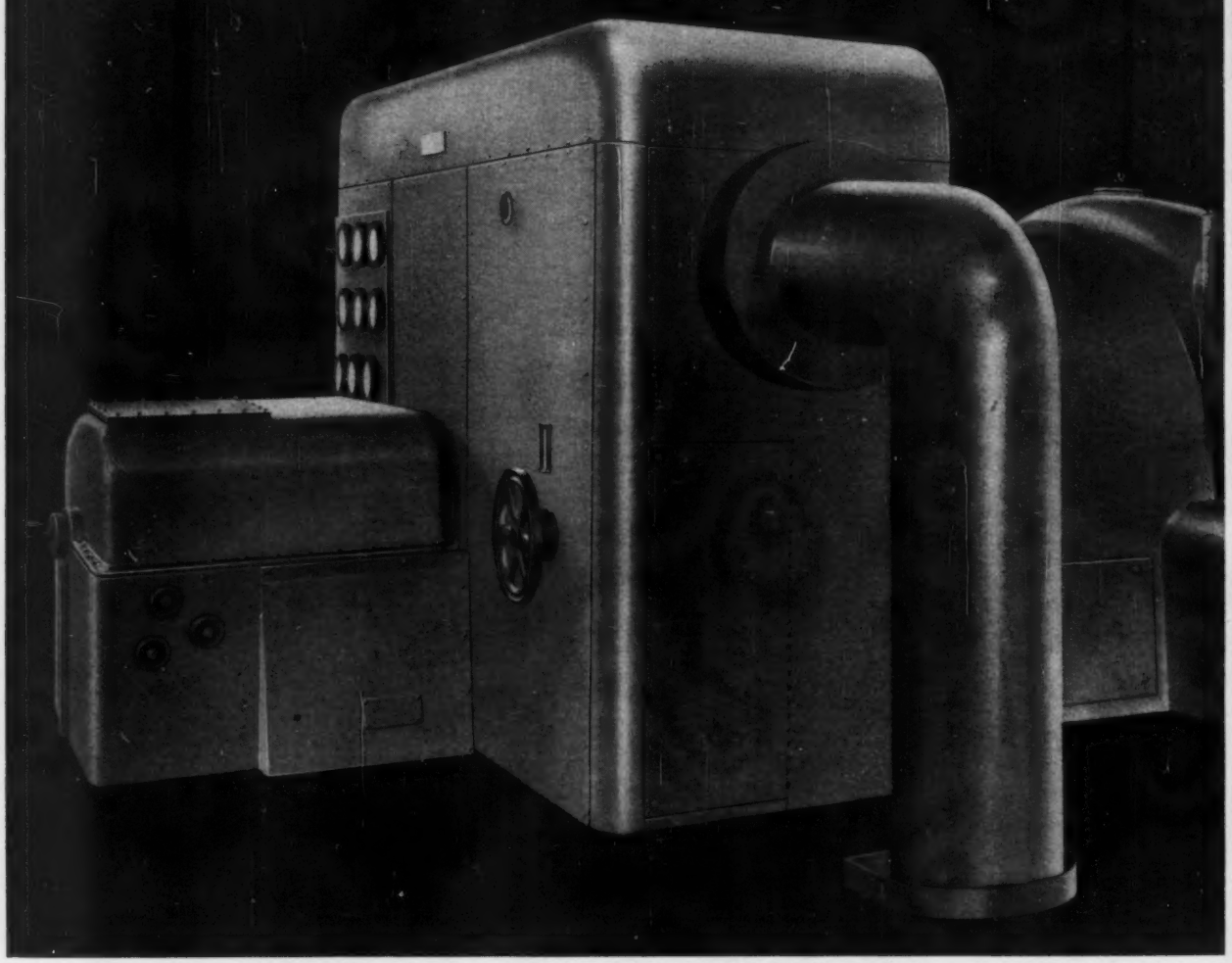
Name_____ Title_____

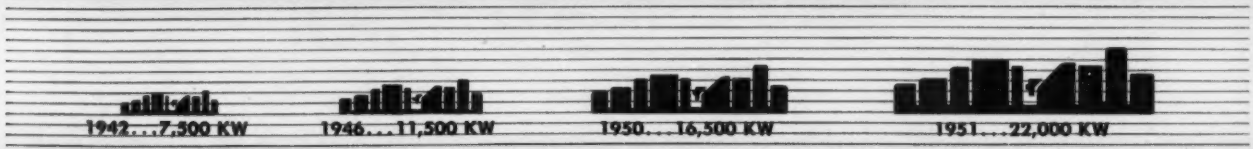
Company _____

Address _____

City_____ Zone_____ State_____

A solid background of TURBINE-GENERATOR





Year after year . . . Elliott turbine-generators are

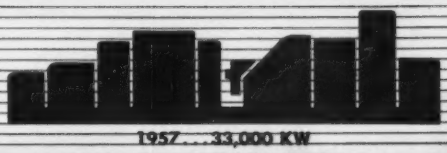
EXPERIENCE

The excellent operation of this 16,500-kw hydrogen-cooled turbine-generator unit is the result of Elliott Company's background of 50 years experience in designing, and building turbine-generator units. The steady march in size ratings is accomplished by a step-by-step introduction of proven components added to each larger size.

Elliott is currently building a 33,000-kw unit and has the facilities, experienced engineers, and craftsmen, to produce size ratings to 44,000 kw. For complete engineering data, call your nearby Elliott district office or write Elliott Company, Steam Turbine Department, Jeannette, Pa.

ELLIOTT Company

HB-4



1957 . . . 33,000 KW

getting Bigger and Bigger

In this turbine-generator aisle, Elliott has the large machine tool equipment and handling facilities for manufacturing. Under construction is a 33,000-kw unit—designed and built to meet the exact requirements of the user.

In 1923 this was EHV

Lapp "high strength" suspension insulators were used by Southern California Edison Co. for its 220 kv Eagle Bell line. Erected in 1923, this line is now in its 35th year of service. Original insulators are still in place. Company reports "no trouble"; total replacement of insulators for all causes over 34 years is "less than 1%."

"Design for electrical security and long life—then do all you can to make it strong." This has been a Lapp principle from the beginning. In 1923, when the line shown above was erected, the insulators on it were cataloged as 18,000-lb. units—at a time when the industry was talking generally of 9,000-lb. and 12,000-lb. units. Before, and since then, Lapp has pioneered in insulators that combine long life with high mechanical strength.

For your EHV and other high-mechanical-loading requirements, specify the current Lapp 25,000-lb. suspension units; another generation of operating people in your company will be proud of the service records they set.

Lapp Insulator Co., Inc., Le Roy, N. Y.

No. 5 in a series

Right off the Wire

An automatic ultrasonic welder makes tack welds without heat at the rate of 200 inches per minute.

&

Miniature mercury lamps are being used in batteries of twelve for night aerial photography. An area of sixteen square miles can be lighted from an altitude of 20,000 feet.

&

A new electron microscope permits the examination of opaque specimens.

&

An electronic converter makes any radio an appliance timer.

&

A three-year test of a 43,000-pound ship's propeller made of nialite (nickel-cadmium bronze) shows no wear caused by erosion or cavitation.

&

D. W. Kitchin and O. S. Pratt of Simplex recently made two major discoveries in studying corona spaces in cables — one, by observing internal pressure decrease, and another by mapping with silver cyanide solution.

&

A distillation column sixteen feet high and made entirely of glass is said to be the world's largest. It will be used to make silicon carbide with impurities of only one part in ten billion.

&

It has been demonstrated for the first time that petroleum is a colloidal dispersion. This knowledge may help in obtaining greater recovery from existing oil reserves.

&

A giant machine to hold large assemblies for welding can lift, tilt and rotate weights up to forty tons.

&

A tiny photoflash bulb is said to give the same amount of light as one four times its size. It uses zirconium rolled to foil gauge.

Over 1300 industrial concerns in this country are now using radioactive byproducts. About 200 were added to this list during the last year.

&

Air power for generators in remote installations, such as aids to air or marine navigation, can be supplied by a modern windmill which has a thirty-foot, three-bladed "propeller." It maintains constant speed.

&

Temperatures as high as 3500°F. are resisted by a new molded plastic.

&

Polyethylene is now made with an ultraviolet inhibitor and is said to last four times longer than the unprotected form.

&

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

&

Nuclear reactors may be used as economical sources of heat to convert coal into gaseous or liquid fuels.

&

A stereo cartridge to play the 45-45 Westrex groove records is in production.

&

South Carolina is putting its automobile drivers' licenses on photosensitive, anodized aluminum. They will be used for four years.

&

Speeds of 15,000 miles per hour and temperatures as high as 18,000°F. can be reached momentarily in a new wind tunnel being built to test missile nose cones.

&

"Silicone Insulation as Applied to Wire and Cable" is the title of a research paper by P. H. Ware of Simplex. This insulation is trade named "Thermoplex".

Flexible tanks of rubberized fabric are being made for use in the oil fields. They hold 15,000 gallons, but can be rolled into a package eight feet by two and one half feet when empty.

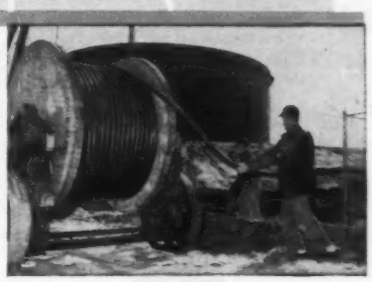
&

Kraft paper, shrunk after forming, is being used for shopping bags and multi-walled sacks. It stretches under tension and is said to be twenty per cent stronger than papers now in use for this purpose.

&

A portable scale that needs no pit is made for roadside weighing. It can handle vehicles sixty feet long weighing seventy tons.

&



Protection plus

C-L-X (sealex) is a continuous, lightweight, exterior metallic cable sheath recently introduced by Simplex. Impervious to gases, chemicals and water, C-L-X is ideal for almost any installation including aerial applications, industrial distribution and direct burial, as shown above. Practically any type of cable core can be used for such applications as power, control, signal and communication installations.

Other features include extreme pliability, ease of handling, long life, easy installation and relocation, and color coding for voltage or circuit identification.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

"The American manufacturers of transoceanic telephone cables"

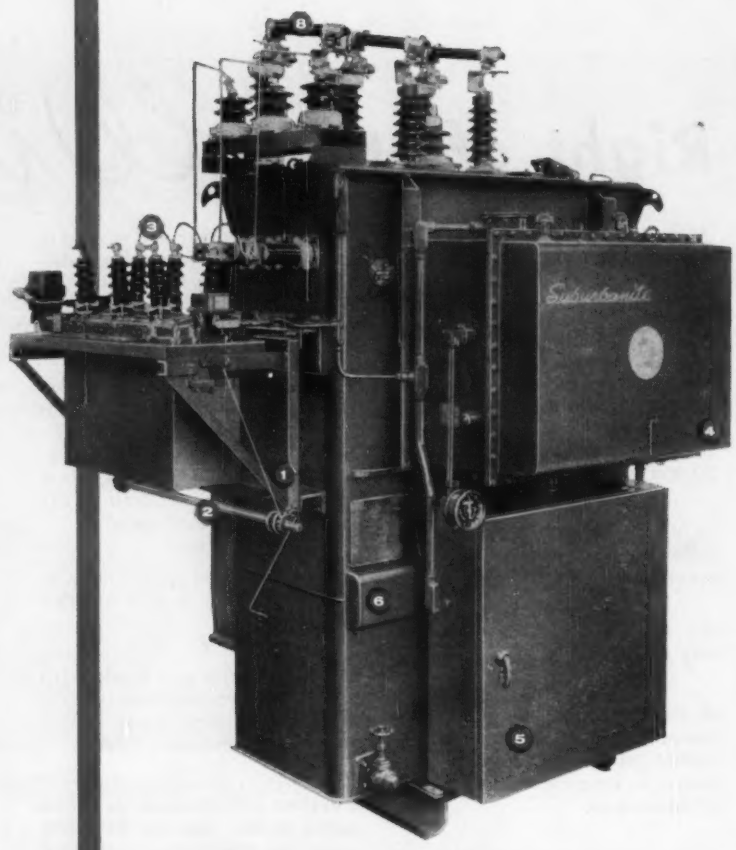
SUBURBANITE DESIGN DETAILS

External

1. Recloser framework is mounted directly to transformer. Shipped completely assembled.
2. Built-in winch simplifies inspection and maintenance of recloser. Bottom section of recloser tank, with oil, can be lowered—while top section, with contacts exposed, remains in place.
3. Flexible connectors between transformer low voltage bushings and recloser prevent strain from thermal changes or vibration.
4. Hood of LTC compartment is hinged for easy access.
5. Metering equipment is located in easy-to-reach cabinet.
6. Sealed transformer tank is reinforced to protect against positive and negative operating pressures.
7. Built-in dead-ending structure (not visible in photo) is provided on the high voltage side.
8. High voltage bushings equipped with fuses.

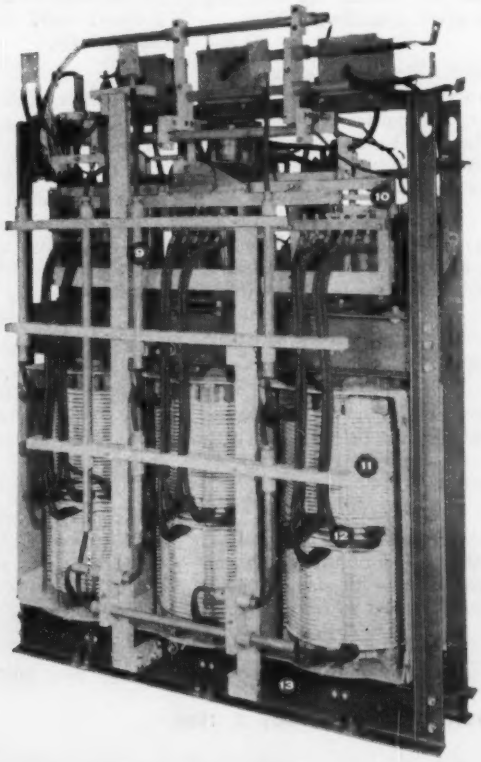
Internal

9. Leads are well supported and are insulated in heavy pressboard tubing.
10. Tap changer for de-energized operation features Pennsylvania's exclusive "straight-line" construction.
11. Pancake-type high voltage coils provide exceptional mechanical strength. Coils are precompressed to prevent distortion or displacement during short circuit.
12. Taps are arranged to assure electrical and mechanical balance and to minimize impedance variation.
13. Core-and-coil assembly is enclosed and clamped in a rugged, four-sided, structural steel frame.



PENNSYLVANIA SUBURBANITE

1000 kva, three phase, 60 cyles. High voltage: 22900Δ volts. Low voltage: 4360Y/2520 volts, with LTC equipment for ±10% regulation in 32 steps of ⅝%.



For rural areas, small towns, and outlying industrial plants...

the PENNSYLVANIA "Suburbanite"

A new, factory-assembled, low-cost, one-piece substation

SAVES 25%... CUTS INSTALLATION TIME

Pennsylvania's new Suburbanite substation — specifically designed for use in less populated areas—saves as much as 25% in initial cost, compared with other types of substations. Because the substation is factory-assembled and shipped in one piece, additional savings usually result from the simplicity and ease of installation, for which no additional steelwork is required.

FASTER INTERRUPTING TIME

The Suburbanite provides this outstanding economy without sacrificing necessary efficiency and safety. Instead of an air or oil circuit breaker, it utilizes a completely automatic recloser that is mounted in framework attached directly to the transformer. The recloser clears the low voltage line in just 2½ cycles in the event of a fault —or twice as fast as the equivalent oil circuit breaker.

FLEXIBLE IN DESIGN

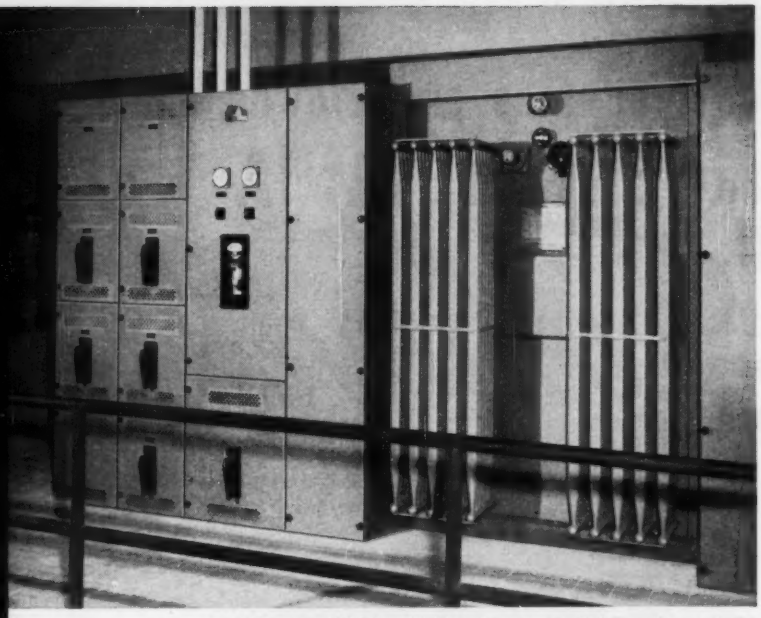
The Suburbanite can be tailor-designed to fit individual requirements. Optional equipment includes metering devices . . . load tap changing in the low voltage . . . high and low voltage lightning arresters . . . and high voltage fuses. High and low voltage lines can be brought directly from a nearby pole to dead-ending frames mounted on the transformer.

Want to know more about the Suburbanite . . . its economy and ease of installation as they apply to your specific requirements? Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA POWER TRANSFORMERS

WAGNER Close-Coupled Transformer permits compact load-center for TRANE COMPANY



This Wagner 1000 kva Noflamol close-coupled Transformer is installed in Trane Company's new $1,250,000 Engineering Building.

One of the many unusual features of The Trane Company's new Engineering Building at LaCrosse, Wisconsin, is a display room for the air conditioning equipment that serves the building. A full glass wall in this room permits visitors to view the Trane CenTraVac water chiller and master control panel, the pump room and the unit substation that handles the power load distribution for the building.

A Type JP 1000 kva Wagner close-coupled transformer was chosen to power the unit substation. Wagner close-coupled transformers fit flush against the switchgear enclosures, eliminating throats and saving space. Connections are made at the bushings on the sides of the transformer. Bushing heights are designed to give ample room for connection to switchgear or busses and eliminate need for special throats to match special switchgear. These noninflammable liquid-filled transformers are available in ratings from 500 through 2000 kva.

Consult your nearby Wagner Sales Engineer about the complete Wagner line of Unit Substation Transformers —both liquid-filled and dry-type. Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copy today.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

WT58-2

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

STRENGTH

of the RIGHT kind... in the RIGHT place

Bushings work for you this way —, but they travel and arrive on the job this way —. Design adequate for this position — may not be enough for this —.

Roads -- concrete or steel -- have bumps. Freight handlers can be a bit butter-fingered. These shocks beyond the line of duty can cause radial displacement of parts.

O-B condenser bushing design takes these special demands into consideration. Axial assembly compression is imposed by a series of massive *coil* springs. These have big amplitude of movement, if necessary, uniform force, and complete recovery. One of the characteristics demanded of O-B gaskets is an ability to cling to a surface -- not be slippery. Another characteristic is high mechanical strength and stability. Metal mating surfaces are "trapped" to provide greater radial gasket support.

O-B has not spent its entire 50 years of bushing-building experience on radial strength factors, alone, but during that 50 years we have been taught the *absolute need* for strength of the right kind, in the right place.

This is all part of the reliability that has been built into O-B condenser bushings. They are easy to get. Just be sure to *ask for them* when you buy new station equipment.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4906-H

"WHY buy more

Clamp than I need?"

NEW O-B QUADRANT STRAIN CLAMP IS EXCELLENT FOR LOW-COST DEADENDS

"Why buy more clamp than I need?"

If that's your question, then the new O-B light weight Cooline LW clamp is your answer.

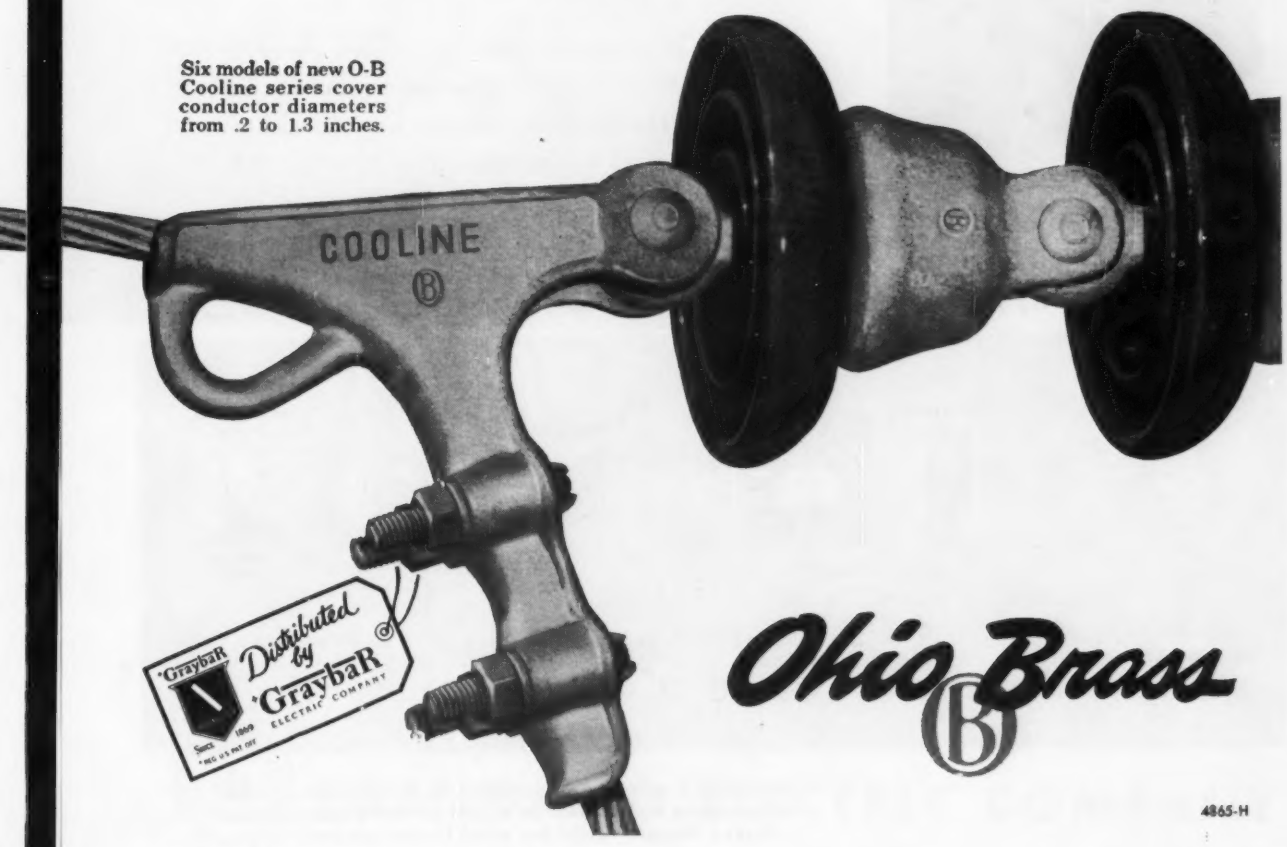
It's the same basic design as the heavy-duty aluminum Cooline clamp, used for many years on transmission, sub-transmission and primary distribution lines. But this new aluminum quadrant strain clamp, is lighter weight, costs less, and is designed especially for low stringing tensions.

Like the heavy-duty Cooline, the new LW clamp has a powerful snubbing action which has high holding power without crushing the conductor. The six models in the new Cooline series cover a range from .2 to 1.3 inches in conductor diameter, with ultimate strengths from 7000 to 18000 pounds. Conductor can be strung at deadends with continuous loop . . . no need to cut and splice.

Here's a clamp that is right in step with today's trends in distribution and transmission construction and in keeping with the O-B policy of offering the widest available selection of materials for deadends. Ask for this new O-B Cooline LW the next time you order strain clamps.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Six models of new O-B Cooline series cover conductor diameters from .2 to 1.3 inches.



Ohio Brass

4865-H

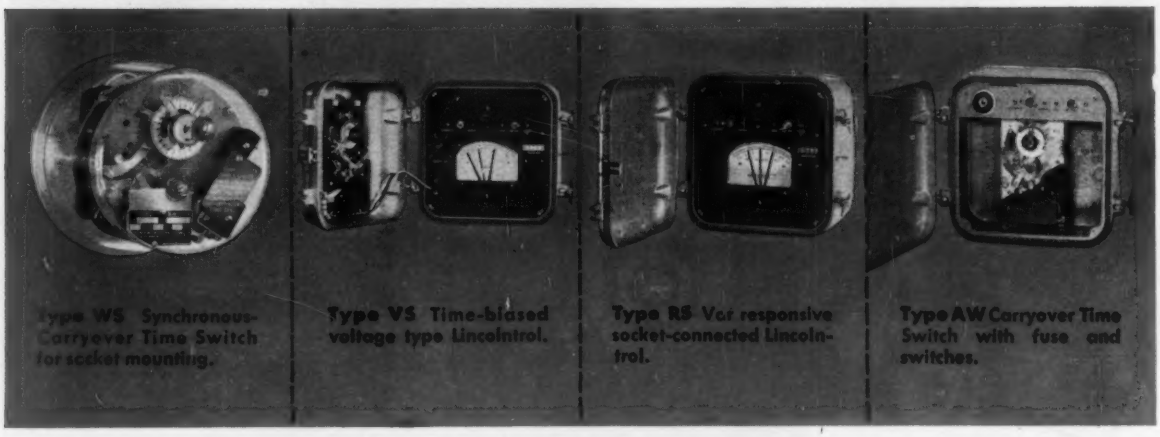
SANGAMO AUTOVAR CAPACITOR EQUIPMENTS

...low in cost...light in weight ...quick and easy to install

Sangamo pole-type Power Capacitor Equipments are completely assembled—wired at the factory—ready for automatic operation. They enable fast, easy capacitor installation on distribution circuits in amounts approximating peak load kilovars.

Available in multi-row design for crossarm mounting and in-line design for direct pole mounting, in all distribution voltage ratings and with standard Kvar ratings from 225 to 600 kvar. Equipments include mounting rack, capacitor units, electrically operated oil switches (optional), junction box and all wiring.

The industry's most complete, versatile and economical control equipment...



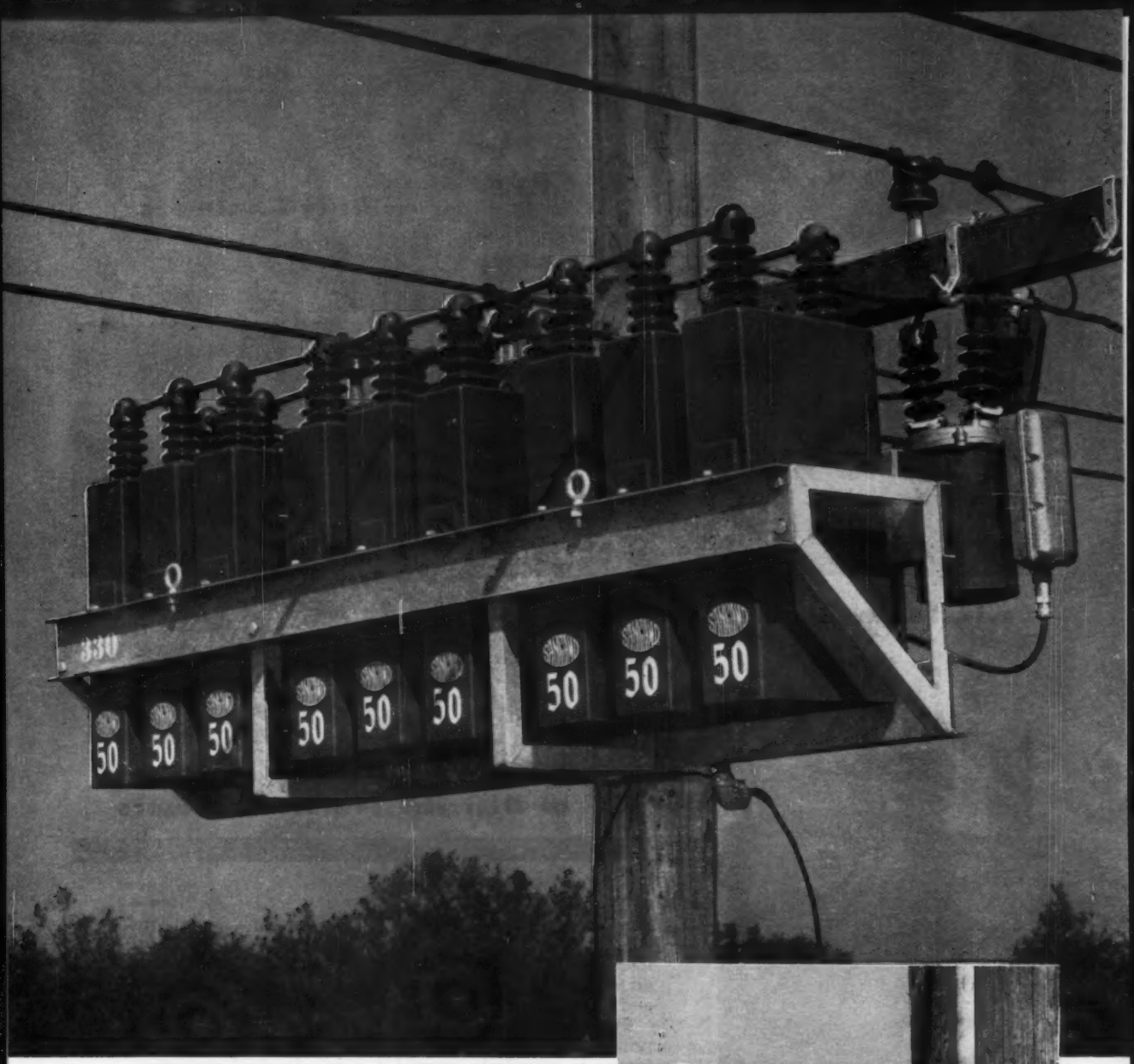
Type WS Synchronous-Carryover Time Switch for socket mounting.

Type VS Time-biased voltage type Lincolntrol.

Type RS Var responsive socket-connected Lincolntrol.

Type AW Carryover Time Switch with fuse and switches.

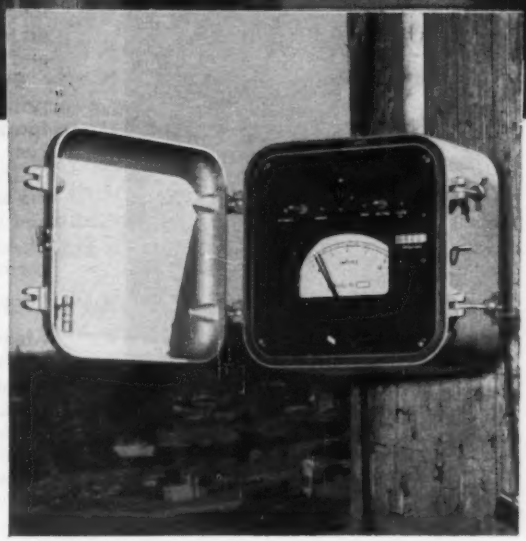
Whether you control capacitor switching as a function of time, volts, amperes, watts, or vars—or as combinations of these functions—there's a Sangamo control best suited for your purpose.



A typical pole-mounted 450 kvar in-line switched capacitor equipment, with 50 kvar, 2400 volt Sangamo Capacitors.

The capacitor switching is controlled by the Type AS current responsive Lincolntrol shown at right.

Look to Sangamo for all your capacitor requirements. Ask your Sangamo Representative, or write us for Bulletin 1110.



LIVE BETTER ELECTRICALLY

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

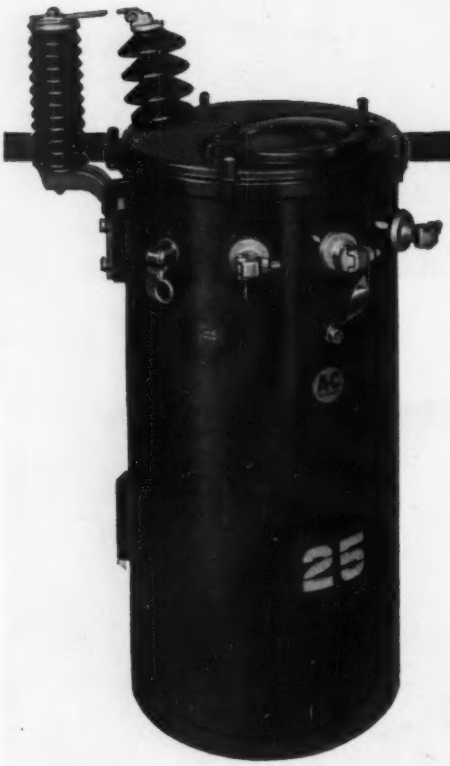
PC58-3

Craftsmanship at Allis-Chalmers

...includes 10 operations to protect

Tank Surfaces

of Distribution Transformers



Advanced engineering, scientific precision and manual skill at Allis-Chalmers extend to every detail of manufacture, including surface finishing. The tank treating process exposes all tank surfaces to five separate chemical and cleaning baths and converts surfaces to a non-metallic phosphate coating.

Synthetic resin base enamel is hot sprayed on tank for both prime and second coat. Both are oven baked. After the transformer is completely assembled it gets its final protective coat of enamel.

This process gives Allis-Chalmers distribution transformers a surface resistant to severest weather conditions, salt and acid atmosphere conditions. The gleaming, gray surface of Allis-Chalmers tanks substantially reduces troublesome corrosion problems.

Extra "Measure" of Corrosion Protection

Magnetic gauging of paint coverage is still another example of the craft and precision in every step of manufacture. Painted tanks are gauged to assure uniform, specified paint thickness when finished.

For the complete craftsmanship story, see your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5556

Insurance Companies Need Education

Representatives of the Cleveland Electric Illuminating Co are in the process of calling upon insurance companies. They are explaining the case for electric space heating for apartments and similar buildings. This activity grew out of the discovery that some insurance companies had refused loans when heating was electric.

Obviously, the very idea that such an educational program is needed at this late date gives a black eye to the industry. Appropriate industry committees should have done this sort of thing a long time ago. Nevertheless, much credit is due the CEI for taking the initiative to do the selling job. But the fact that local insurance company loan representatives in each utility's service area must also be sold should not be overlooked.

What Is the Next Transmission Voltage Step?

It is not too soon, today, for the electrical industry in this country to study the question of the next steps in transmission voltage above 345 kv. Should it be 400, or 460 kv or even higher? Should U. S. systems follow the example set by Europe of adhering to even multiples of a hundred kilovolts? Or should systems here accept increments related by attractive ratios of voltage and capability to popular system voltages now in use?

Foreign preference today for 275/300 and 380/400 kv is founded on international voltage standards that were at least in part based on our rather early use of 287 kv for the Boulder Dam transmission lines.

In the post-war expansion this voltage has been by-passed as too small a step to be attractive on the many 138-kv systems. For such systems 345 kv held out the opportunity to multiply capability six or seven times. As a consequence 345 kv has been embraced here to the extent of some 2,500 circuit miles, and in two other continents as well. Thus it has achieved effective standardization through usage.

What then is the next logical voltage step? With 345 kv widely accepted, the 400 kv international (IEC) standard appears inappropriate in the light of most U. S. system needs.

Opinion seems to be shaping up in favor of 460 kv. With so much 230 kv transmission operating and in prospect in this country, system planners see in 460 kv an opportunity for a five fold increase in capability, and therefore ample justification for its adoption.

Obviously the step from 345 to 460-kv is inadequate to be attractive for overlaying a 345 kv transmission system. Ultimately, something well beyond 460 kv will be needed. This may eventually bring unification with European voltage practice at 550 or 650 kv.

Sales Promotion 'Normal'

- Utilities in harder hit areas, though, are backing 'Buy Now' programs and stepped-up area development work

- PIP proposes plan to tie in with Advertising Council's national 'Confidence in a Growing America' campaign

Elmer Lindseth's signal, above, doesn't denote "V for Victory," although it could be a harbinger of better things to come. The Cleveland Electric Illuminating Co president is giving a "V-V" symbol standing for "Values for You—Vitality for Cleveland."

The event, one facet of the city's "Buy Now" campaign, found the two comely CEI employees passing out invitations to office workers to a gala "Laundry Lane" promotion on washers and dryers.

CEI is one of the most enthusiastic participants of the city's "Buy Now" campaign.

Elsewhere in the nation, though, electric utilities in the main aren't tying in with comparable campaigns. The reason is encouraging. Most of them report no lag in merchandise or electricity sales, except for the general tapering off in industrial load. And many of them indicate regional condition are good.

These observations were gained in a roundup of 30 utilities whose typical reaction was, "We just haven't been hit very hard by the so-called recession."

This healthy state of affairs is bolstered by an EW tabulation of operating revenues of 34 power companies in 22 states. For the first quarter of 1958, these companies had an average 6.3% increase over the same '57 period in gross revenues and an 8.75% gain in net income. Three firms had a dip in gross; nine had smaller net incomes than in the '57 period. The companies with decreases operate in areas dependent upon steel, auto, lumber, and textile industries.

One of the big problems, as a merchandising manager put it, "is not the recession but the fear of one. Talk is what we've got to lick."

The Public Information Program (PIP) agrees. Last week it mailed to executives a report outlining the press reception to a power progress panel (EW, Feb. 10, p 43) and describing the Advertising Council's "Confidence in a Growing America" program.

PIP suggested an eight point outline to help build public confidence in the economy:

1. Cooperate in the activities of the Advertising Council.

2. Seize every opportunity to tell the story of your own company's expansion plans in terms of money, construction workers employed, impact on suppliers involved, customers being added, more appliances being used, and increased industrial use.

3. Publicize forecasts and expansion plans of the electric industry in your region and the country.

4. Emphasize any and all "good news" about the company, the community and the industry.

5. Tie this expansion story into your communications about nuclear power.

6. Make these points in every medium of company communication —from institutional ads and news releases to plant tours and business-education programs.

7. Exert leadership in your area to encourage other businesses and merchants and organized groups to participate in this campaign.

8. Tell PIP about your program so ideas can be fed back to industry.

The PIP report points out that the industry's optimism and expansion are important news during the recession period.

The Ad Council program was keynoted in April by Charles Moritimer, General Foods Corp president who said, "I do not think it is an exaggeration to say that recessions begin and end in the minds of men."

Free material and information has been offered by the council, which is located at 25 West 45th St, New York 36, N. Y. Maxwell Fox, public relations director, is handling requests.

The PIP package followed close on the heels of a General Electric Co plan called "Operation Upturn." The six-month drive will not be "a sales promotional effort based on reducing prices . . . It is a sustained company wide program focused on bringing to the customer the better service and values already available."

Westinghouse Electric Corp's "Sell for Prosperity" appliance promotion has been taken into several major cities, including unemployment-ridden Detroit. Reported results: a 20% sales jump in Detroit, 25% in Chicago and 600% in N. Y.

Hotpoint's push—"OK Ike"—is another recent effort to stimulate sales. It includes lower down payments and easier credit terms on Hotpoint items.

The Ad Council's confidence-building program is getting close cooperation from American Gas & Electric Co. AG&E system Pres

Despite Dip

Philip Sporn is a member of a five-man steering committee of the council's industries advisory committee.

The system has budgeted 6½% more than 1957 for sales promotion, sales ads and area development. Emphasis is on Live Better Electrically, "with the all-electric home our primary goal," a spokesman said.

"Resistance heating of homes is being vigorously pushed, both for older homes as well as new homes," he added. In 1957, 17% of AG&E's resistance heating sales were installations in existing homes.

At Detroit Edison Co, water heaters are getting a big play. Target sales goal for 1958 is 18,000 units (vs. 11,500 last year). Current sales are 50% ahead of April, 1957. An extensive ad program is being carried through with cooperation of six major water heater makers.

Detroit Ed's aim for Gold Medallion (all-electric) Home is 100 for '58. The Medallion Home (everything electric except heating) has a promotional goal of 1,000 homes and the Ready-Wire Plus home is 3,000.

Future Looks Good, Says George

As to future outlook, Vice Pres E. O. George said he expects business to be good in 1959 and unusually good in 1960, "far in excess of the business we had in 1957. The recession has very definitely not affected our long-range outlook, nor in turn, our plans," he said.

In New England, domestic and commercial sales generally are not down but, rather, have not maintained the upward trend of recent years.

Industrial power sales, however, are off. Power company spokesmen say that the major effort by utilities must concentrate on participation in local and regional promotional efforts by chambers of commerce and the New England Council.

Appliance promotions are being pushed in the area. Cambridge Electric Light Co, for instance, has had good initial results with a "package installed price plan" for dryers. The package combines the appliance and installation costs for a unit sales price.

$25 Million Investment In Pee Dee Section
CP&L To Give State Economy A Big Boost
Public Service Electric & Gas to Open Big Station
L. G. and E. To Build New Generating Unit
$250 Million Power Plant Planned Near Hartsville
Vepco Reports Marked Increase In Power Consumption Over State
Duke Power Will Expand
Electric Service Plans for Future
N.C. Plant Addition Dedicated

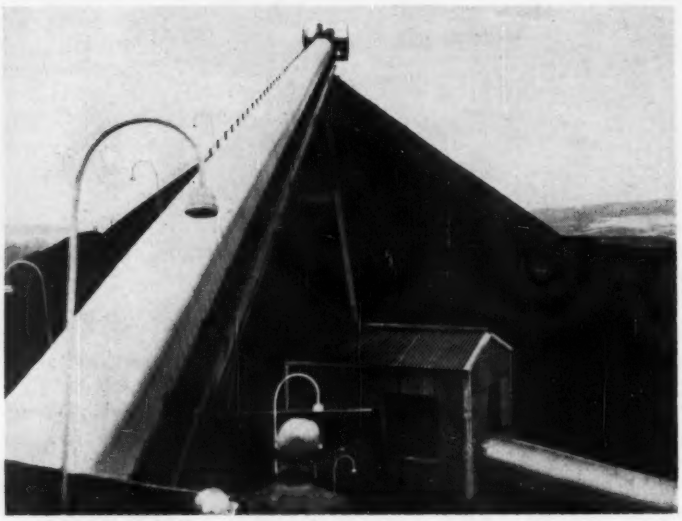
FAITH IN FUTURE theme of news releases is a facet of PIP plan to help boost public's confidence. PIP suggests stress on industry's growth and forecasts

In other areas of the U. S., interesting promotional efforts were reported, none of which were labeled, however, as anti-recession measures. Items:

- Omaha Public Power District's antidote for recession talk is a 15% increase in promotional and advertising effort. A recent range campaign offered the cost of six months free electric cooking, which helped dealers sell 586 ranges.
- Texas Power & Light Co plans to tie in with Hotpoint and GE promotions although, as E. H. Gardiner, Jr, commercial-residential sales manager says, power companies in the area are in good shape. TP&L is continuing a mutual aid development program for farming and business. A work force of 18 men helps farmers find markets for products, and offers aid in establishing industries that will process farm-produced materials.
- New Orleans Public Service Co has four sales campaigns slated on residential lighting. On one, undergraduate college students will make a summer house-to-house canvass. Commercial and industrial lighting workshops, increased sales efforts on outdoor lighting, and a dryer campaign that recently sold 1,172 units for dealers are other activities.
- Duquesne Light Co is mailing a "Shop Talk" publication to 700 small industrial customers to augment calls by sales representatives. It will feature applications promoting new and expanded uses of power.
- A recently completed Oklahoma Gas & Electric Co "Heat Better Electrically" push added 5,820 kw and upped EAR $57,664. A direct mail campaign is underway on industrial ventilation and air conditioning.
- Kentucky Utilities Co's long-range area development drive has been highly successful, said Pres Floyd Fairman. KU in April joined in sponsoring a tour of the state by investment bankers. This month it is co-sponsoring a tour for representatives of major chemical companies.
- Wisconsin Electric Power Co's "Electric Hot Water Jubilee" includes a $10 bonus to dealer salesmen for units sold for existing homes during the drive. A new financing plan offers no down payment for changing wiring and outlets and 36 months to pay, with a minimum payment of $1 month at the regular carrying charge.
- San Diego Gas & Electric Co for the first time is promoting sale of all-electric kitchens and heat pumps. Dealers say lagging appliance sales aren't caused by recession but by discount houses and trend of builders toward more built-ins.
- Southern California Edison Co is concentrating on Medallion Home activity. A contract calling for 451 such homes was signed last week. Additional pacts are expected which will boost the number of all-electric homes in a Long Beach area to 1,000.

Some of these highlights refute the recent expostulation on complacent, routine sales efforts of electric utilities. The admonition, though, to "Get out and sell", which has echoed lately in industry sales meeting halls, is somewhat overdue, based on the efforts of and attitudes at a sizable share of the electric utilities contacted by Electrical World.

Pipeline Slurry Worry Nearly Over

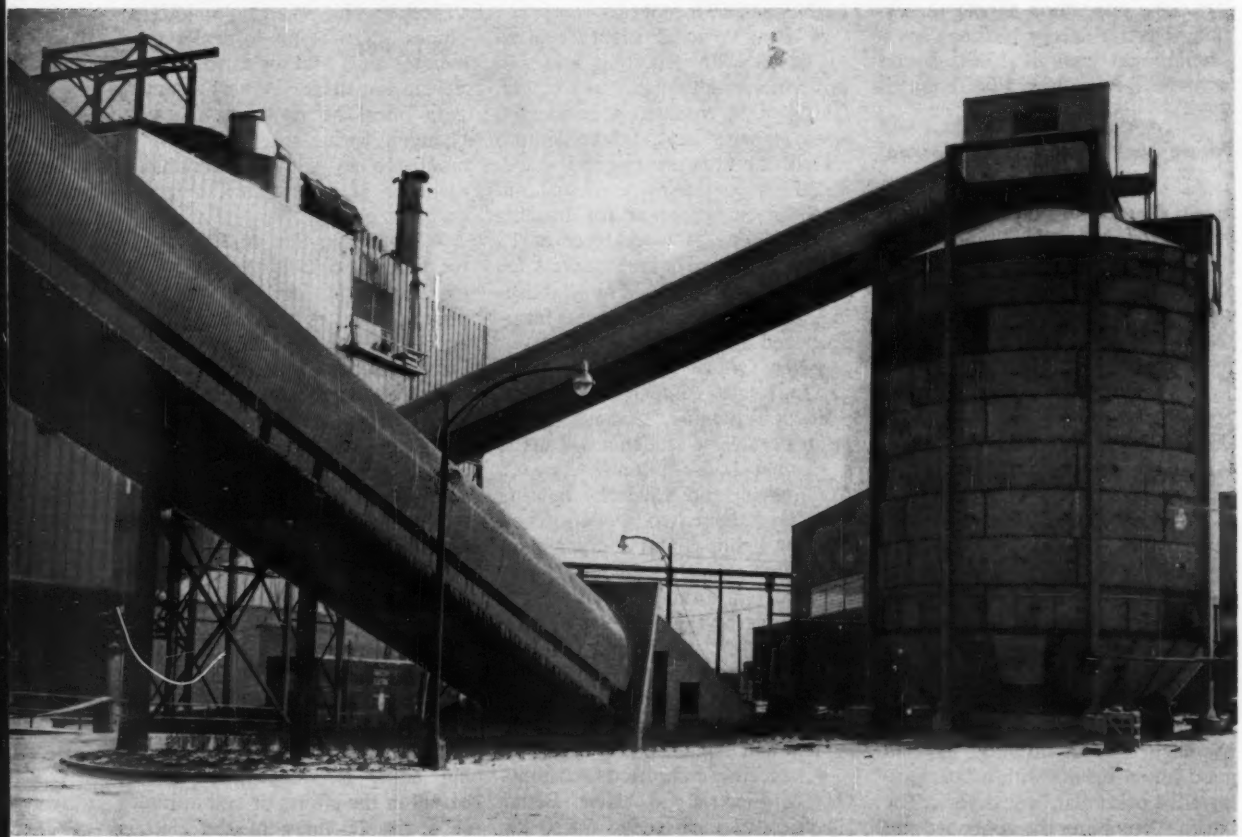


INTRICATE PREPARATION PROBLEMS at coal mine near Cadiz, Ohio, are grinding and screening coal, underwater coal storage and recovery

Within the next two months the world's first cross-country coal pipeline will begin to transport fuel from mine to plant on a commercial basis. The 108-mile link between Cleveland Electric Illuminating Co's Eastlake station and coal mines of Pittsburgh Consolidation Coal Co will deliver some 1.25 million tons per year, enough to supply 80% of the plant's fuel requirements (EW, May 6, 1957, p 55).

Final testing of the $12.5 million pipeline has centered in CEI's drying plant at the delivery end of the line. Extensive test runs in recent months have attacked two basic problems:

- Moisture control—When coal is too dry, heavy dusting occurs.



EASTLAKE'S $2.5-million drying plant, left, is fed coal by lines (in background) from settling tank. After drying process coal goes to storage bin (right). Test operation has attacked problems of moisture control, coal size mixture

at Eastlake

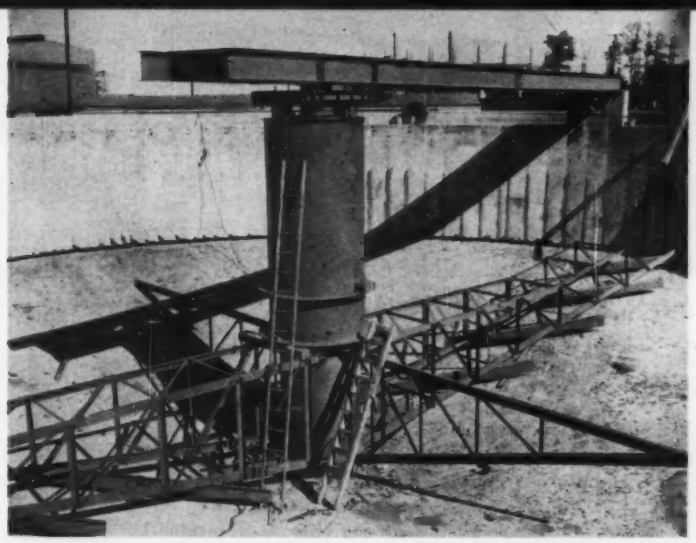
This has been controlled by a mixing device that combines coal in various stages of dryness to arrive at a workable moisture content.

● Coal size mixture—Slurry from the pipeline contains coal particles ranging in diameter from that of a grain of dust to $\frac{1}{16}$ in. Operation of the vacuum disc filter, first step in the de-watering process, demands a mixture of these sizes. The disc filter starts the drying process both by drawing off water and by passing air through the coal inside the drum. A heavy concentration of fine, dust-like coal inside the filter forms a thin coating of the inner surface, which prevents the flow of air and reduces efficiency of the operation. Presence of the coarser particles in the mixture forms the voids that permit passage of air through the coal.

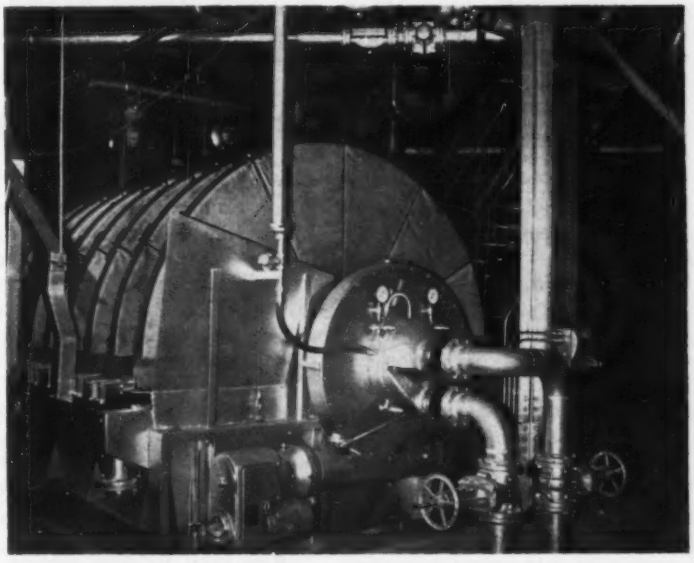
Achievement of the most efficient mixture of sizes, the key to both the transportation and processing of pipeline coal, has demanded adjustments at the Pitt Consol preparation plant near Cadiz, Ohio, where coal is crushed, screened, and started on its way to Eastlake.

Fine coal pumped from the Cadiz cleaning plant is dropped onto screens; the size passing through is suitable for pipeline slurry. It is transferred then to a drag tank where sizes are separated. Excess coal is directed to one of three storage ponds—the first pond for any fine overflow from drag tanks, the second for excess product from drag tank discharge, and the third for storage of oversize particles from the screens.

"The coal has been coming up very well" from the preparation plant in recent tests, said a CEI spokesman. The line has operated for continuous runs as long as three weeks. Maintenance shutdowns have taken from two to 48 hours. As for the future, "pipeline transportation is here to stay if present freight rates are maintained." This is the view of Clarence A. Dauber, director of civil and mechanical engineering for CEI, who foresees a larger number of coal pipelines in use in the years ahead. "Many will be used to convey a variety of bulk material," he believes.

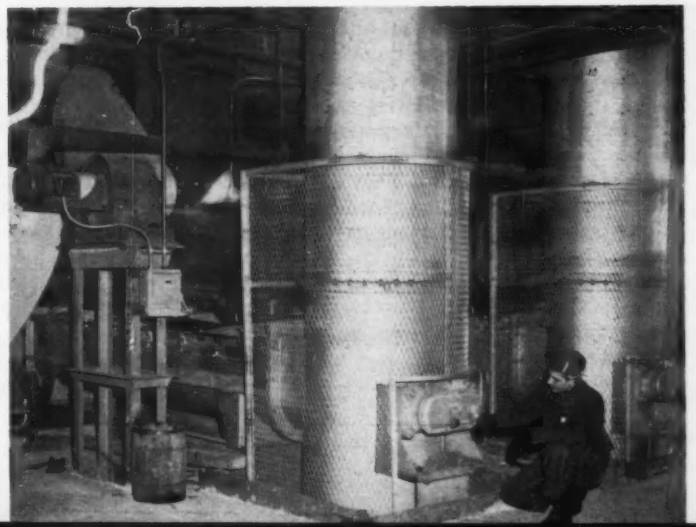


SLURRY STIRRING TAKES place in a 90-ft dia settling tank, or thickeners where slowly rotating blades tend to make coal solids agglomerate



COAL SLUDGE is pumped next to vacuum disc filters. Drying starts by drawing off water and passing air through coal. Dust-like coal is problem

FLASH DRYERS reduce coal to about 5% moisture. Absence of much ash in coal will cut stack discharge to about 65% of pre-pipeline emission



TVA: Growth or Sale of Power Facilities?

Agency manager predicts eight-fold increase in annual use by 1983. U. S. Chamber of Commerce recommends sale of power facilities to private or public local-level groups

The Tennessee Valley 25 years from now will be a region with mass producing pastures under aluminum sheds and a consumption of power eight times the present TVA rate.

This was the speculation about the valley's future given as the annual convention of the Tennessee Valley Public Power Association, marking observance of the 25th anniversary of TVA, came to a close.

G. O. Wessenauer, TVA manager of power, set the tempo for TVA specialists when he labeled his forecasts as "speculations instead of predictions."

But against his forecast of 250 billion kwhr annual use of power by the valley 25 years from now—eight times present use—he could set the fact of a 20-fold increase in the last 25 years.

Use of water by municipalities and industry and for recreation was foreseen as "overshadowing" the value of its use for electric power.

E. H. Wright, association president, reminded that "much work remains to be done," with emphasis on "full speed ahead for the valley."

Meanwhile, the U. S. Chamber of Commerce's 46th annual convention in Washington, D. C., approved resolutions calling for sale of TVA's power facilities to local or state organizations, and transfer of TVA's other operations to the Army Engineers.

The resolutions urged Congress to amend the TVA Act to "authorize and encourage" private or public groups at state or lower levels to purchase and operate TVA's power facilities. The Army Engineers would be given operation of TVA's multi-purpose dams for flood control, navigation and low-flow regulation.

Other recommended amendments to the TVA Act include:

- Restriction of TVA power to its present service area.
- Elimination of the "sole-supplier" clause in TVA power contracts.
- Regulation of TVA-generated power sales by the Federal Power Commission, based on new rates to cover all production costs, including: operation and maintenance, interest payments to the U. S. Treasury, amortization, replacements, and the equivalent of federal, state and local taxes that would be payable, if TVA were privately owned.

The U. S. chamber also recommended that, pending adoption of these amendments, Congress should maintain control of TVA until all its operations are transferred. And finally, TVA should be required to continue repaying, until the transfers are completed, its appropriation investment in power facilities at no less than the rate established in the Government Corporations Appropriations Act of 1946.

No other valley-type power authorities should be established in the U. S., the chamber also said.

Pro-Private Power Sentiment Polled

A majority of voters in three New York, California and South Dakota congressional districts favor private power development over federal power, according to polls conducted by their Republican congressmen.

Rep Harold Ostertag received 7,000 returns from a poll of his New York 39th district, indicating 57.3% favor private-federal partnership in developing atomic power for peaceful uses. Private development is favored by 27.3%, federal development drew 11.1%, and 4.3% are undecided.

Rep John Baldwin reports that 51.3% of his constituents in California's sixth district answered a poll in favor of federal encouragement for private power production, while 30% favor federal development and 11.7% are undecided.

Rep E. Y. Berry's canvass of his South Dakota second district indicates that 68.4% of the voters favor "the present policy of allowing private companies to develop atomic power." Against are 9.2%, while 22.4% are undecided. In another response to Berry's poll, 48.8% voted against developing "new federal public power and irrigation projects," while 34.2% voted for them and 17% said they are undecided.

Berry's poll also shows 73.4% of his constituents favor cooperatives being taxed "on the same basis as other business," with 15.4% against and 11.2% undecided.

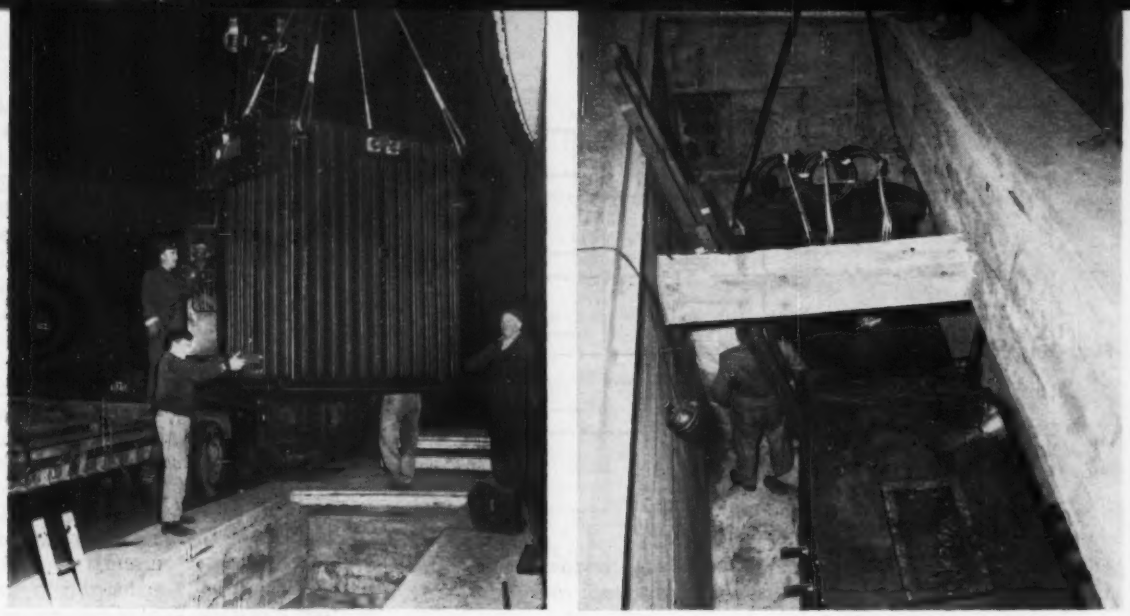
GE Ups Turbine Prices 3%; Westinghouse Starts Study

General Electric Co announced last week a price increase of 3% in the products of four departments of the Turbine Division.

The price increase will affect all steam turbine-generator units manufactured in Schenectady, in Lynn, and Fitchburg, Mass.; marine propulsion and gear units manufactured in Lynn, mechanical drive turbines and ship service turbine-generator sets manufactured in Fitchburg, and gas turbines manufactured in Schenectady.

W. S. Ginn, vice president and general manager of GE's Turbine Division, stated that the increases are a result of an adjustment to partially meet rising materials and production costs.

C. I. Mauntel, sales manager, Steam Division, Westinghouse Electric Corp, told Electrical World last week: "Price structure of turbines and related equipment is under study but there has been no decision to change prices at this time."



Space-saving 250-kw silicon rectifier is installed in a special sidewalk manhole

Silicon Rectifiers Solve DC Problem

Four 250-kw submersible oil-cooled silicon rectifiers are operating successfully on Boston Edison Co's dc network

A. F. ANDERSON, and **A. F. CORRY, JR**, Engineering and Construction Department, Boston Edison Co, Boston, Mass.

Four 250-kw submersible oil-cooled silicon rectifiers, operating in parallel with existing rotating equipment, were installed in late 1957 on the Boston Edison dc network. The units are operating quite satisfactorily.

The load on the dc network has decreased from its peak of 80,000 kw in 1946 to 44,000 kw in 1956. Also, the character of the load has changed from uniform distribution to widely dispersed spot loads. These factors have resulted in a decrease from 17 to 11 dc substations, rearrangement of feeders, and freeing subtransmission lines for use as supply lines to parts of the ac system.

The establishment of a group ac network feeder bus at one of the generating stations made it desirable to free several 15-kv lines from supplying a dc substation in the North End section of Boston. Of the 1,200-kw load in the area, 200 kw could be picked up on feeders emanating from other substations, leaving the remainder of 1,000 kw to be supplied by one of the following methods:

1. Supplying the substation by lines originating at another generating station.

2. Extending dc feeders from adjacent substations into the area.

3. Installing rectifiers at the dc load centers.

The first method was not feasible because the available short-circuit current of the new lines was far above the interrupting capacity of the circuit breakers at the substation. To rebuild them, purchase new breakers, or install reactors would have been time-consuming and costly.

$100,000 Saving

Cost estimates indicated that the third scheme—installing rectifiers—would result in a saving of $100,000 over the second method. Such savings had not been possible prior to the advent of silicon rectifiers because the physical size of the more common types of metallic rectifiers precluded their use in street manholes. For example, a 250-kw silicon rectifier is contained in the same size tank as a 50-kw selenium rectifier.

In addition, rectifiers are advantageous in view of the continuing decrease and change in character of the dc load. An investment in a facility which could be readily shifted to the load areas is more attractive than in one which is inherently less adaptable to shifting loads.

A map of dc feeder locations and their peak loads was used to determine the best location for the rectifiers to supply proper capacity and voltage to the overall system. It was highly advantageous to supply each of the rectifiers from a different regulated 4-kv circuit. They were connected between two sectionalizing switches to facilitate isolation of units from the ac supply and to transfer the load to an adjacent circuit in case of trouble.

The rectifiers and associated distribution transformers were installed in sidewalk manholes so designed that when the rectifiers are no longer needed, they may be replaced by secondary transformers.

The rectifier circuit consists of five full-wave bridges per phase with each bridge protected by a 250-amp silver-sand fuse. Each bridge utilizes four hermetically sealed silicon

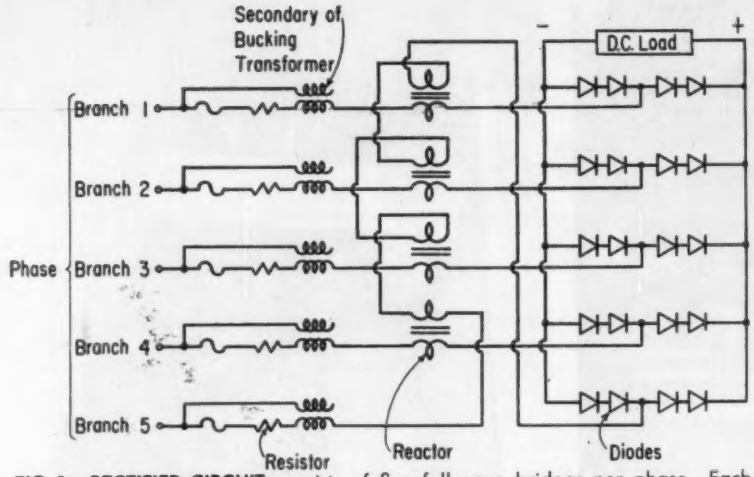


FIG 1—RECTIFIER CIRCUIT consists of five full-wave bridges per phase. Each bridge uses four silicon diodes with peak inverse voltage rating of 350 v

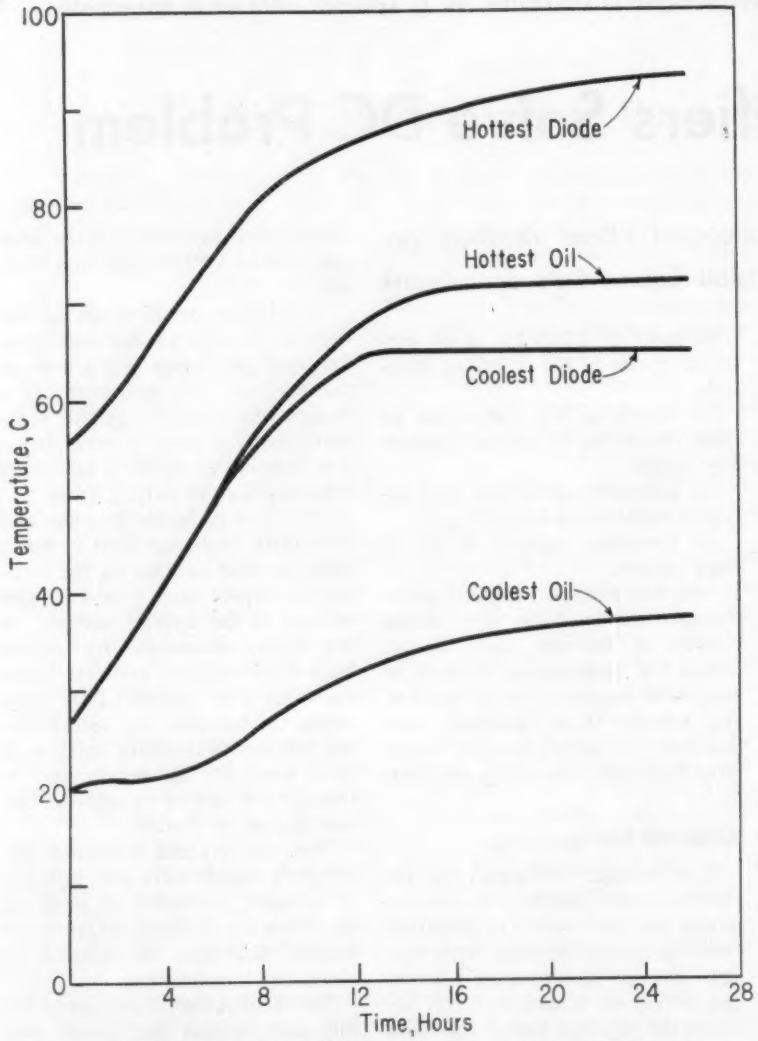


FIG 2—TEMPERATURE-TIME CHARACTERISTIC for oil-immersed silicon rectifier shows that steady-state case temperature of hottest diode was 93C—some 7C below presently allowed hot-spot limit on oil-immersed distribution transformers

diodes, each of which has a peak inverse voltage rating of 350 v. At the present stage of development it was thought prudent to use two diodes in series in each arm of each bridge. This assures continuity of service at rated load in case of failure of one of the diodes. A simplified internal schematic diagram is shown in Fig. 1.

Cells Share Current Equally

Since the individual diodes have a wide variation in forward current with relatively small changes in forward voltage drop, it is important that the cells be extremely well matched at the factory to insure equal sharing of current. In addition to the use of matched cells, an effort was made to have connections between cells symmetrical and of equal resistance; and to have connector length, cross section of wire, and type of connection for each parallel branch as nearly equal as practicable.

In spite of all these precautions, however, it was found necessary to use combinations of resistors and reactors in each of the bridge circuits to attain proper current division. Typical current distributions are shown in the accompanying table.

Diodes Immersed in Oil

Perhaps the most novel aspect of the installation was the immersion of the diodes in oil. Existing literature and field experience had been primarily concerned with diodes operating with forced-air cooling.

It was necessary, therefore, to conduct full-load heat runs with thermocouples at strategic points. In all, temperatures were measured at 36 points on the diodes, case, and oil, and at four points on the bucking transformer. The ambient temperature during the tests ranged from 20C to 36C, with the average about 34C.

The temperature-time characteristic thus determined is shown in Fig. 2. It will be noted that the time necessary to reach the steady-state temperature was of the order of 26 hr. At this time the case temperature of the hottest diode was 93C—some 7 deg below the presently allowed hot-spot limit on oil-immersed distribution transformers.

Since the diodes are very sensitive to overvoltages and overcur-

rents, even those of a few microseconds duration, it was necessary to investigate ways of minimizing failure from either cause.

Field measurements with a transient peak voltmeter showed that no damaging surge voltages would be encountered under a variety of switching operations. The major design effort was therefore concentrated on overcurrent protection. A number of tests simulating short circuits resulted in the decision to protect each bridge and the dc output with current-limiting fuses.

To this end 15 250-amp silversand fuses were factory-installed in each unit, and 2 1,000-amp fuses were installed in the output cables in the manhole. Thus far one of the output fuses has blown on the occasion of a fault on the network, clearing the rectifier with no diode damage and no blowing of the individual bridge fuses.

98.5% Efficiency at Full Load

Typical regulation of an individual unit is shown in Fig. 3. It will be noted that approximately half the regulation occurs between zero and 30% load and that the output voltage tends to remain constant in the 90% to 100% region. Other characteristics are: Efficiency—98.5% at full load; and power factor—0.98.

The electrical circuitry of the installation is straightforward with the possible exception of the bucking transformer connection. This two-winding transformer, designed to decrease the input voltage from 210 to 189 v, has 15 secondary coils, each connected to one full-wave bridge. Insertion of this reactance into the individual branches tends to equalize the distribution of current.

Very Satisfactory Regulation

The first rectifier went in operation in August 1957, two others in October, and a fourth in November. All are performing quite satisfactorily. Fig. 4 shows curves of dc load current and output voltage of a typical rectifier operating under normal conditions over a 24-hr period. It should be noted that the regulation of the dc voltage is very satisfactory due, in some degree, to the voltage level maintained on the regulated 4-kv circuits and the support afforded by the dc feeders.

Typical Current Distribution

Phase	Branch 1	2	3	4	5	Average	Max. Deviation
1	138	135	160	155	150	147.6	± 8.5%
2	132	140	145	158	161	147.2	±10 %
3	139	133	142	142	163	143.8	±13 %

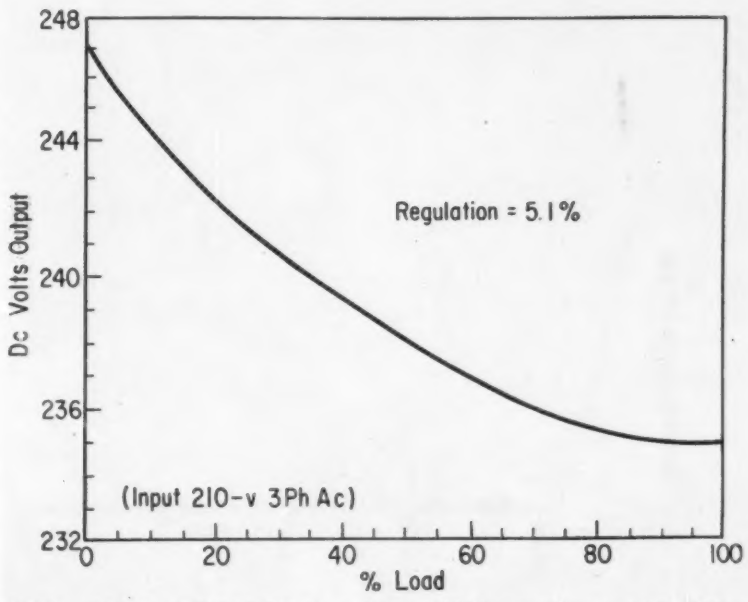


FIG 3—TYPICAL REGULATION for individual 250-kw rectifiers is 5.1%. Other characteristics are: Efficiency at full load—98.5%; power factor—0.98

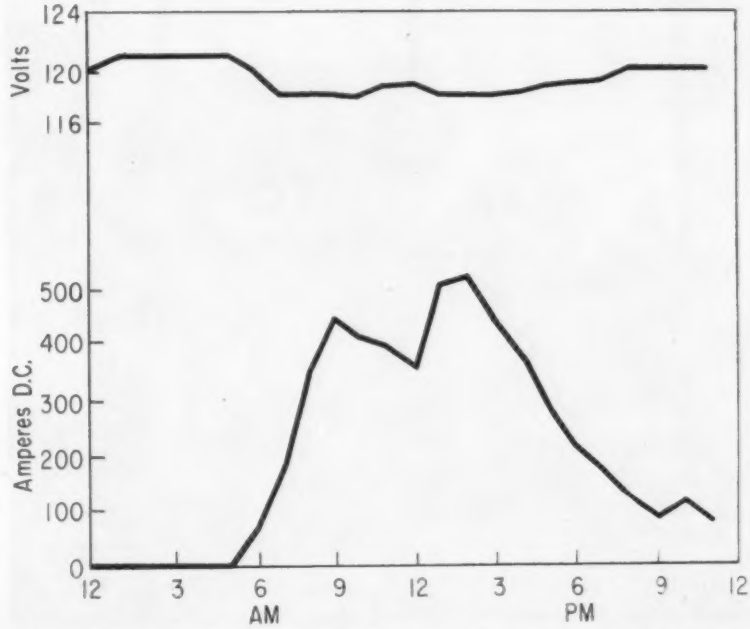
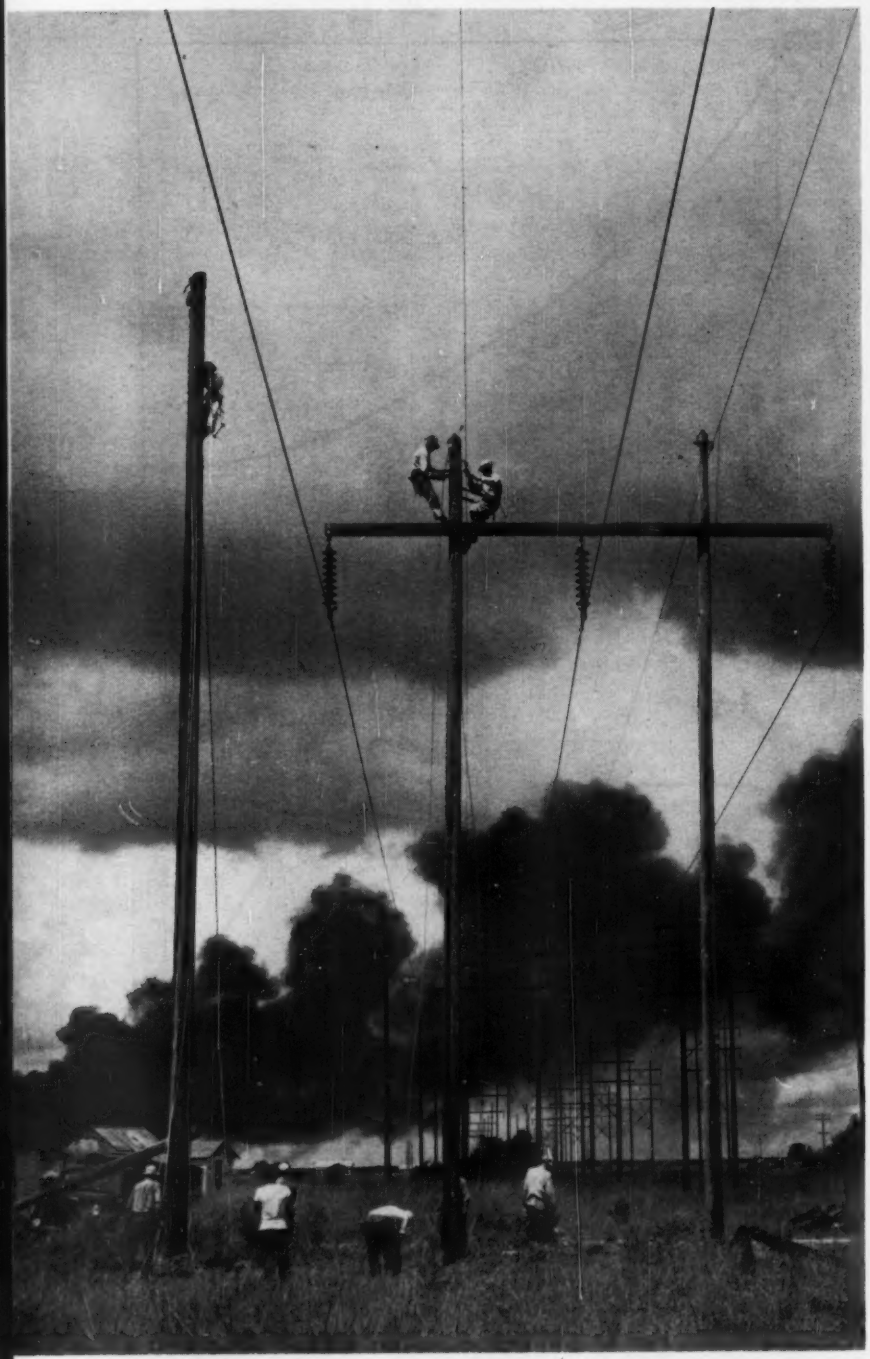


FIG 4—REGULATION OF DC VOLTAGE in operation is very satisfactory, due somewhat to voltage level on regulated 4-kv circuits and support by dc feeders

Pole Added, Old One Stubbed

Refurbishing 20 structures was work of several days yet planning kept actual outage time to only 8 hours



THIRD POLE is shown already set to the left of the existing two-pole structure, and the construction crew is starting to raise an additional angle crossarm

Double circuiting a section of the 138-kv transmission line of the Gulf States Utilities Co between Neches and Dayton, near Beaumont, Texas, involved changing pole structures from H-type to K-type. This change was made by adding a taller pole and two crossarms, and raising and stubbing one of the poles already installed.

Changes in the line were designed jointly by engineers of Gulf States Utilities and of Stone & Webster Engineering Corp, and the construction was completed by Stone & Webster who had built the original transmission line 19 years before. Although actual field construction took a number of days, the circuit was out only 8 hr. This outage occurred while the new conductors were cut in at the completion of the structures. In all, changes were made on 20 structures.

Phases Are 15 Ft Apart

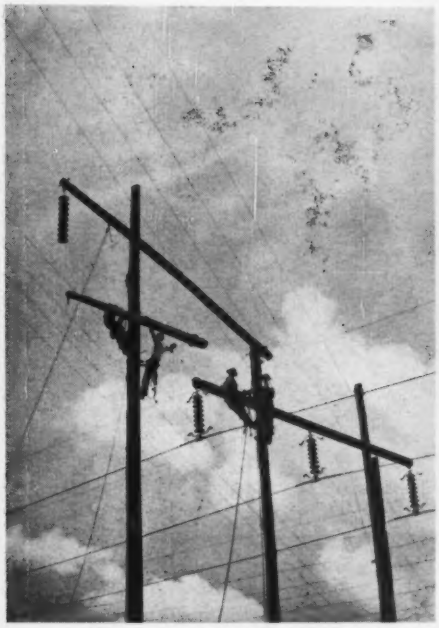
Size of the original and added conductors was 336.4 MCM ACSR 26/7 strand, and the overhead ground wire three No. 7 stranded EHS Copperweld. Original phase separation of the single-circuit line and final separation of the double-circuit line was 15 ft between all phases supported from the lower horizontal arms. The two phases on the outside were arranged one nearly over the other, with a vertical clearance of 12½ ft.

Circuit Energized

After the new and higher poles, with one crossarm per structure, were installed, together with the insulators, the two new conductors were pulled in and sagged. Up to this time the initial circuit remained energized. When the connections had been arranged at both terminals to make a new circuit, consisting of the two new and one old (outside) conductor, it was energized.

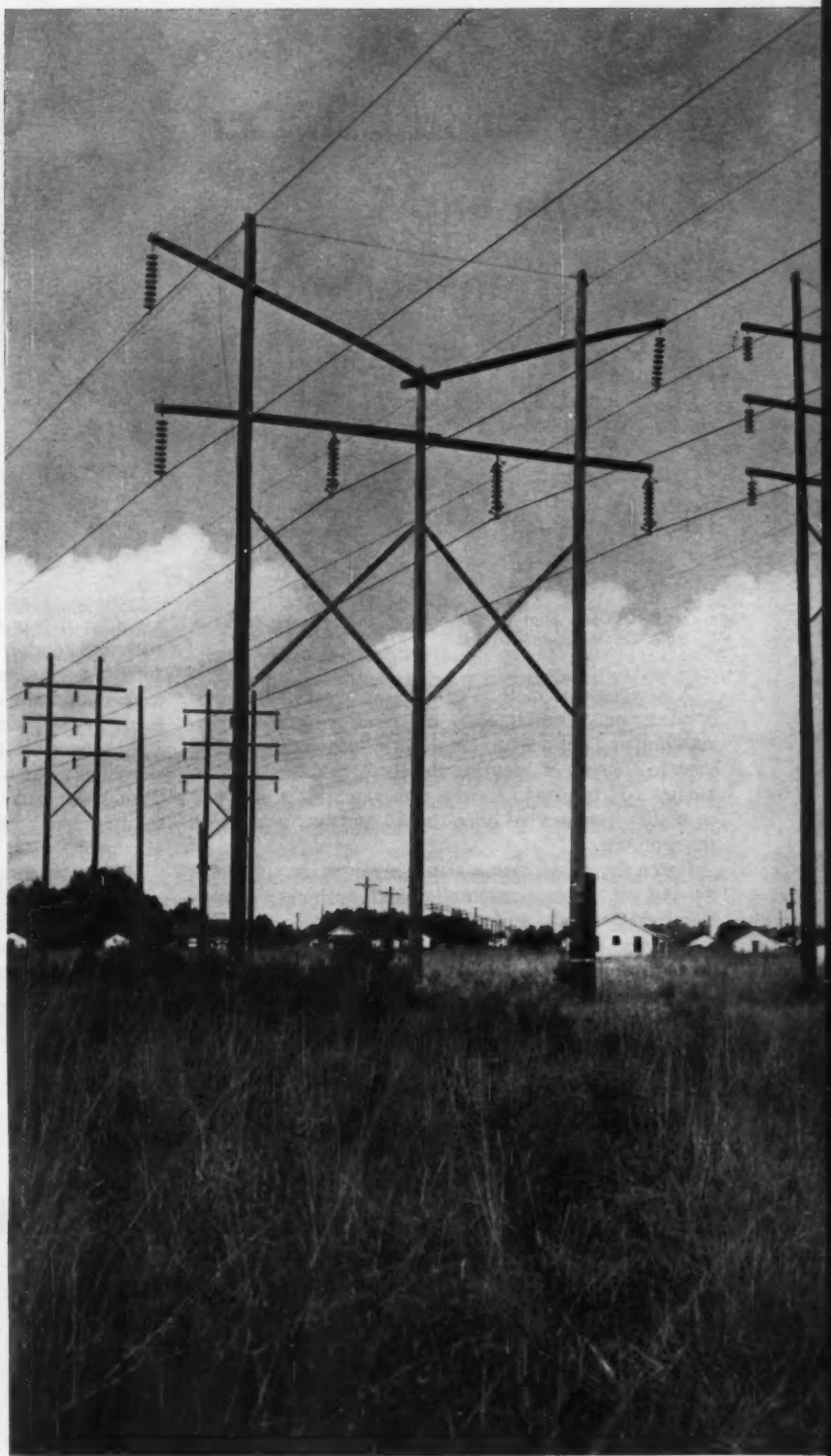
In the second phase of the operation, the original poles were raised and stubbed. The second crossarm, one insulator string, and the cross braces were then added, and the third new conductor was strung. This third conductor completed the second circuit, consisting of one new and two old conductors.

To Take New 138-Kv Circuit



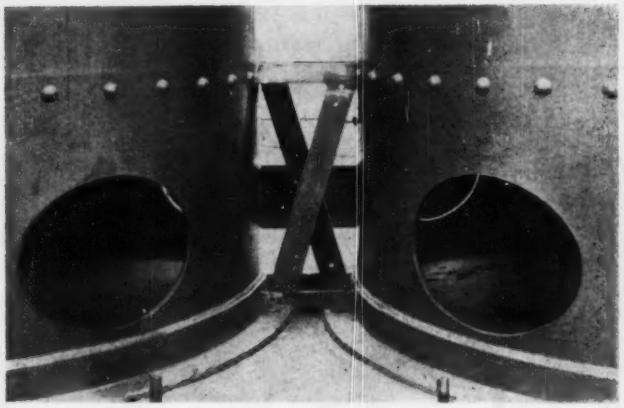
NEW HORIZONTAL ARM is made fast to old structure and new pole

NEXT STEP is raising and stubbing right-hand pole of original structure



COMPLETELY MODIFIED STRUCTURE shows how right-hand pole was raised out of the ground and stubbed to bring it to height of new pole at the extreme left

Now You Can Cut Time and Costs of Transporting 138-Kv Breakers



TEMPORARY WELDS tie three tanks together so crane can lift one side at time for placing pair of H beams under breaker. Then welds are cut and tanks bolted to beams to form permanent assembly which can be easily moved

J. R. **KROEGER**, Supt of Substations, Indianapolis Power & Light Co, Indianapolis, Ind.

A new simpler method of moving 138-kv oil circuit breakers cuts overall costs by eliminating most dismantling and extra work involved in reassembling. The scheme consists of securing the three breaker tanks to a pair of H beams to form a firm assembly which can be readily transported once the oil and two vent pipes are removed.

Formerly, transporting these breakers required removing oil, contact assemblies and bushings, current transformer leads and conduits, interpole operating rods, pipe housings, tank tie rods, and other parts. As the company's heavy underslung trailer could accommodate only two tanks, two trips were required to haul the three tanks to the new site.

Reassembling the breaker involved extra work also. Usually, it was necessary to chase the threads on tie rods and conduit and to replace damaged current transformer wiring between tanks. The new method, however, eliminates most dismantling and extra work and, consequently, cuts overall costs.

First step in the new scheme is to weld temporarily the three tanks together, using channel and angle irons. Tieing the tanks together permits setting them up in the new site without having to reestablish spacing and alignment.

After the three tanks are welded at the base, the oil is removed from each. All control cables are disconnected, and their conduits removed or their ends freed of the mechanism cubicle. Bushing leads and tank clamping plates are also removed, and the breaker is then ready for lifting.

The company's 20-ton mobile crane is moved into place beside the breaker, positioned so that the boom

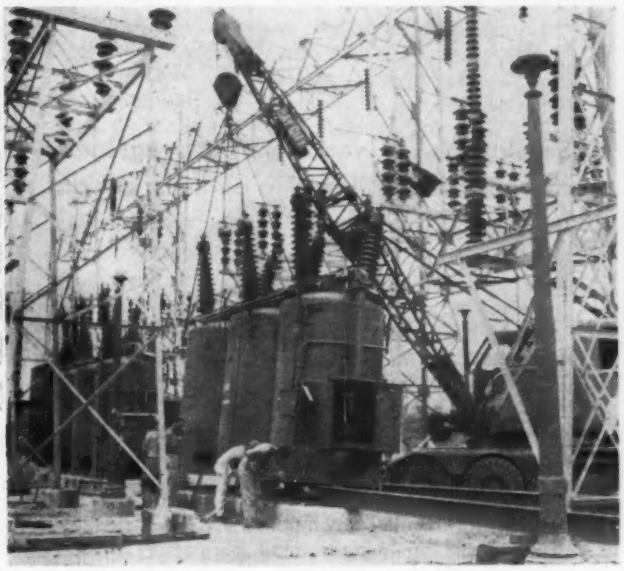
Four Ways to Avoid Hazards of Static

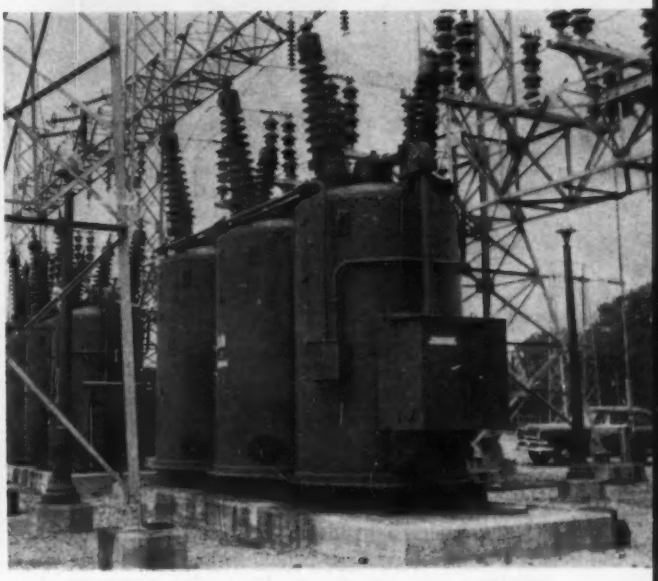
F. W. **FRECKER**, Safety Director;
A. R. **COWAL**, Division Distribution Superintendent, Ohio Power Co, Canton, Ohio

Shocks or minor burns from static discharge can be so startling or surprising as to lead to more serious accident or injury. Hazard of static discharge can be avoided by observing four precautions based on the nature of static electricity and limitations of line guards in preventing static discharge. The precautions are:

1. All energized conductors are surrounded by an electrostatic field, whose strength depends upon the voltage of and distance to the conductor.

2. An object suspended within the field will become charged. Because linemen usually are between such charged objects and ground potential, static electricity generally discharges from the object to the lineman, or from the lineman (who has become charged) to the pole, the towers, or to any other body





can make a lift on either side. The complete breaker is tilted by lifting one side about 8 in. above the pad. Four or 5 cribbing boards, about 2 x 12 in. by 4 ft, are placed under each tank and the breaker lowered onto the cribbing.

The other side is then raised in the same manner about 12 in. above the pad. A 10-in. H beam, 49 ft per lb and 21 ft long, is pulled under that side of the tanks on ¾-in. rod rollers.

When the beam is in position under the breaker, the tanks are lowered almost to the beam. Heavy C clamps are used to clamp the beam to the tank flange bases. The rod rollers are removed, and the breaker and beam lowered to set on the pad.

The other side of the breaker is then raised, the cribbing removed, and the second H beam positioned. Beam spacings are checked and adjusted, and the breaker tank clamped to the beam. Then the breaker and beam are lowered onto the pad. Each tank flange is secured to the beam with 8 ¾-in. bolts, two at each point where the flange sets on the beam.

The two welded temporary members with their bracing are then cut out, and all weld beads removed from tank flanges. Four 6 x 6-in. angle cross members are welded into the inside beam web sections to form a permanent rigid base for the tanks.

With the breaker tanks securely fastened to this rigid base, the assembly can be lifted onto a low-slung trailer for moving to any site. In one case, a 44-mile trip was made. Loaded on the trailer, the breaker stands 20 ft 7 in. above the roadway.

A new concrete pad has been designed for use with the beam-mounted breakers. It consists of a footing slab with three piers projecting out of the ground to support the beams at three points. It represents a saving over the conventional design.

Discharge

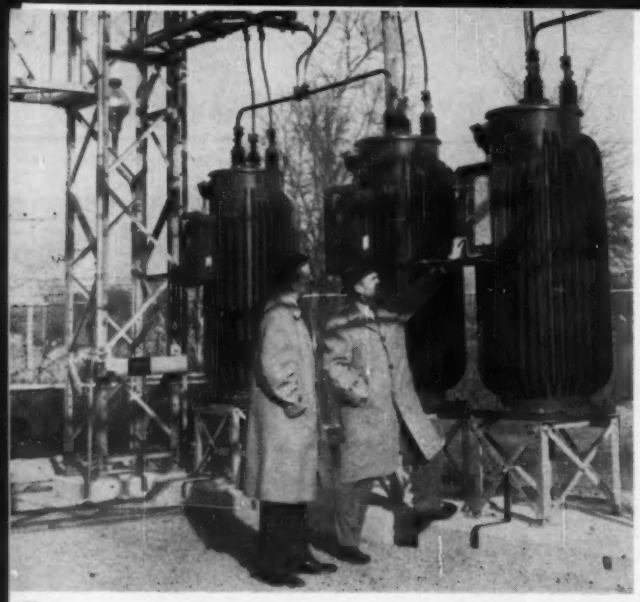
which is at ground potential.

3. Insulation guards do not shield or neutralize electrostatic fields; they are placed over energized conductors only to prevent direct contact with the conductor. Consequently, insulator guards should not be contacted.

4. To move objects close to energized conductors and into a strong electrostatic field, always use hot sticks.

To illustrate how static discharge can have serious consequences, consider the case of a lineman, assisted by another lineman, working on a pole newly-installed between two 33-kv circuits. It was decided to attach temporarily a 45-kv pin-type insulator horizontally to the new pole and tie it to the adjacent 33-kv conductor to prevent contact with the pole.

During the attempt to insert the insulator shank into the pole, the insulator (radio-proof unit with copper tie wire) touched the line guard on the 33-kv conductor. Because of its nearness to the energized 33-kv circuit, the insulator became charged. Static discharge injured the lineman on both thumbs, and so startled him that he dropped the insulator.



Step Regulator

Simulation of variations in regulator characteristics will lead to optimum design

H. L. **PRESCOTT**, Transformer Division, Westinghouse Electric Corp, Sharon, Pa.

Today's analog computer techniques for analyzing step-voltage regulator performance yield valuable new information which brings the optimum regulator one step closer. An analog computer allows a thorough quantitative explanation of how regulator performance is affected by variations in characteristics, a job which has been considered a near-impossible task. Some of these characteristics are the spacing of taps on the autotransformer, the settings of the voltage-sensing and time-delay relays, and the operation of the tap-changer mechanism.

These and other variable characteristics of a step regulator have interrelated effects on performance, with the effect of one masked by the others. It is improbable that a mathematical relation can be derived explaining regulator performance as a function of the characteristics. Although different combinations can be tested and overall performance observed, complete laboratory analysis is impracticable because of the many combinations.

Simulates Step Regulator

But what combination of characteristics will give the best regulated voltage at the lowest possible first and maintained costs is the big question. The general purpose analog computer is one way to get an answer, in that it provides a unique solution by accurately simulating the step regulator. It can generate and introduce typical line voltage fluctuations to the simulated regulator and record the resulting regulated voltage. Different characteristics can be tested quickly for their effects on performance simply by changing corresponding parameters in the computer.

To illustrate how the computer is used, consider two existing regulators which differ mainly in their control and tap changer mechanisms. They were simulated with general circuit diagrams on the computer and compared for operation efficiency and regulation effectiveness. Time delay and voltage sensing devices of each regulator, being unique in operation, required different representations. Specifications of regulator components were varied by changing the analogous circuit parameters of the computer. Of special interest was the effect time-delay settings have on performance.

Control of regulator A consists of an induction disk voltage-regulating and time-delay relay having inverse time characteristics. With this control, large voltage variations are corrected with shorter time delay than are small voltage changes. Tap changer of regulator A changed output voltage by 1½-v steps at intervals of about 1 sec if successive operations were required.

Control of regulator B is of the balance-beam type teamed with a reversing time delay. With this control, the time delay runs at synchronous speed whenever voltage goes outside the set bandwidth. When the voltage re-enters the set bandwidth the time delay reverses and returns to neutral. Time-delay settings of 15, 30 and 60 sec were selected. Tap changer of regulator B changes voltage by ¾-v steps at intervals of about 7 sec if successive operations are required. How both types of control were simulated on the computer is shown.

For an accurate analysis of performance, simulated regulators must be exposed to voltage fluctuations normally encountered in actual operation. Three basic types of fluctuations exist in the field—sudden voltage changes, smooth trends, and high frequency oscillations or hash voltages, separately or in combination.

These voltage changes were generated by special integrators and summers in the computer: Voltage trends of 2 and 8 v per hr as might be encountered in slow load additions; line voltage fluctuations of 4 v to represent system switching and sudden load changes; and hash voltages as produced by starting of welders, arc furnaces and other high-current devices. Combinations of hash voltages and smooth trends of 2 and 8 v per hr also were generated.

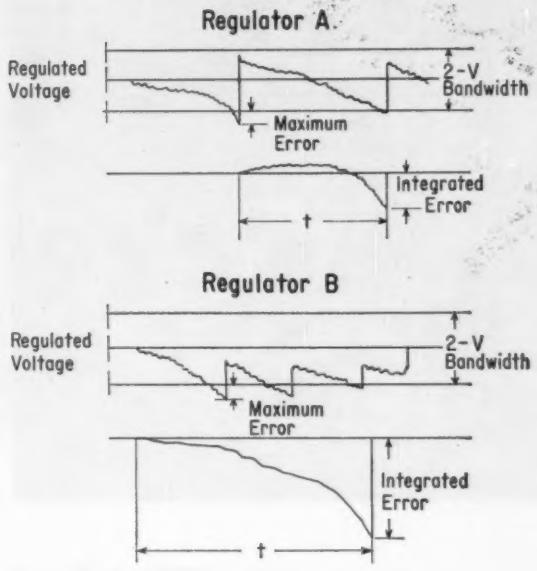
For each voltage condition the simulated regulated

Design Checked on Analog Computer

voltage was recorded graphically as shown in the accompanying voltage curves. Maximum error of regulated voltage and number of tap changer operations required are indicated. Integrated error of the operation was calculated automatically and graphed for the test's time duration. Average error may be calculated easily by dividing integrated error by total elapsed time of the run.

With both simulated regulators set for a 2-v bandwith, regulator A limited maximum voltage error to 0.08 v less than did regulator B and held average voltage error 0.40 lower. Regulator A used voltage steps twice as large as those of B, but required half as many tap-changer operations. This difference gains significance from the fact that voltage delivered to a customer often is required to stay within a 10% band. Thus, regulators must be held to the closest feasible tolerance to gain volts for circuit drop. This 0.4-v error then is sizable when compared with the band allowed for regulation.

No specific relation between regulator characteristics and performance can be made as the test was limited in scope. But the computer was able to demonstrate that regulator A limited all voltage changes to a smaller value than did regulator B, except in sudden voltage changes where both regulators had the same maximum error.



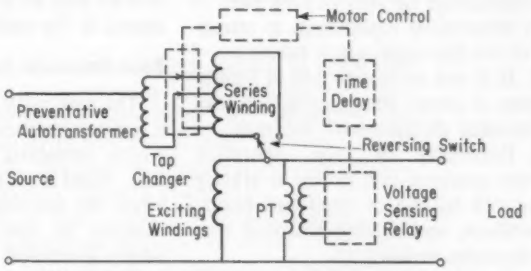
DIFFERENT CHARACTERISTICS are shown when regulators are simulated on the computer. Regulator A, with fewer but larger steps, has maximum error of 0.08 and average error of 0.4 v less than regulator B

How Regulators Were Simulated

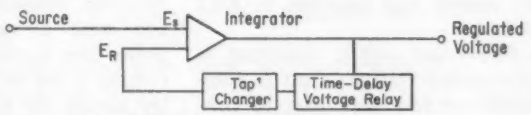
The general purpose analog computer includes integrators, summers, potentiometers, and relays. These devices simulated operation of the voltage-regulating and time-delay relays. A special step-function generator simulated tap-changer operation. Summers and integrators also were used to generate voltages applied to both simulated regulators. The computer summer produces an output proportional to the sum of its inputs. Thus its operation is analogous to that of a voltage regulator. The computer integrator with an output proportional to the time integral of its input provided the time delay function. The relay amplifier detects and reacts to the output voltages of the summer and integrator.

Combination of summer and relay amplifier represents the operation of a voltage-sensing device, or voltage-regulating relay. A computer integrator and relay amplifier together represent the operation of a time-delay relay. The voltage-regulating relay in regulator A required a different approach for its representation. This relay of the induction-disk type provides for both voltage sensing and inverse time delay.

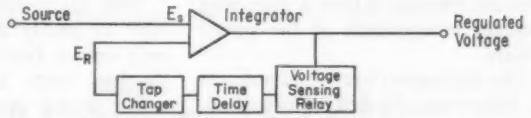
A special device representing the tap changer uses transistor flip-flop, delay and not circuits. Square wave output is integrated to give series voltage E_R. Integrator output always is the summation of the square waves and so represented the amount of raise or lower introduced.



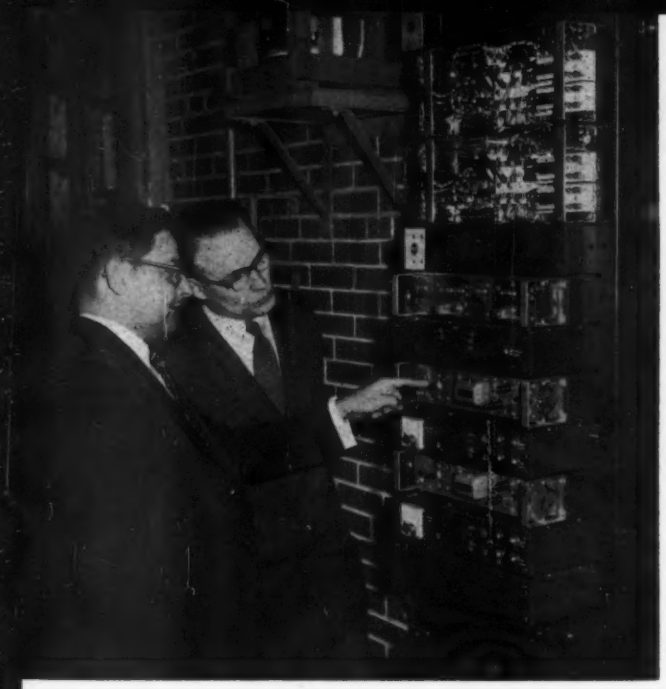
Step-Voltage Regulator Schematic Diagram



Simulation of Regulator A



Simulation of Regulator B



Improve Pilot-Wire Relaying with Modified Audio Tone

Transfer-trip relaying is provided for three-terminal line over leased circuit having 3,000-ohm loop resistance. Audio tone prevents false tripping from noise

GEORGE W. FOX, Electrical Engineer, Union Electric Co, St. Louis, Missouri

New microwave accessory equipment, modified for pilot-wire application, will provide Union Electric Co with audio-tone transfer-trip relay protection for a three-terminal 138-kv line. The fully-transistorized equipment, designed by Radio Corporation of America as part of its microwave equipment, is attractive for this application because:

1. It is not as susceptible to limitations of circuit constants as are conventional dc pilot-wire schemes.
2. Possibility of false operation from spurious line noises is greatly reduced by use of front-end filters, rectifiers, and double-balanced discriminator techniques.
3. Guard and trip signals are supervised. The equipment will transmit and receive trip impulses in 8-12 millisec.
4. Power-line carrier spectrum is not crowded further. Cost is comparable or less than that of conventional power-line carrier.
5. It allows tripping through a fault because relaying is over a pilot-wire channel independent of the power system.

The equipment has the advantages of fully-transistorized construction, such as ruggedness and long life, battery drain of less than 250 ma at 125 v, and negligible warm-up time. The rack-mounting equipment is of modular design, with cabling plugs interconnecting a receiver and transmitter. Test facilities are brought to the front of the chassis as color-coded pin jacks. With the equipment serviceable from the front, it may be placed against a wall. Tuning procedure is simplified in that all instruments are contained in the units.

Four Schemes Available

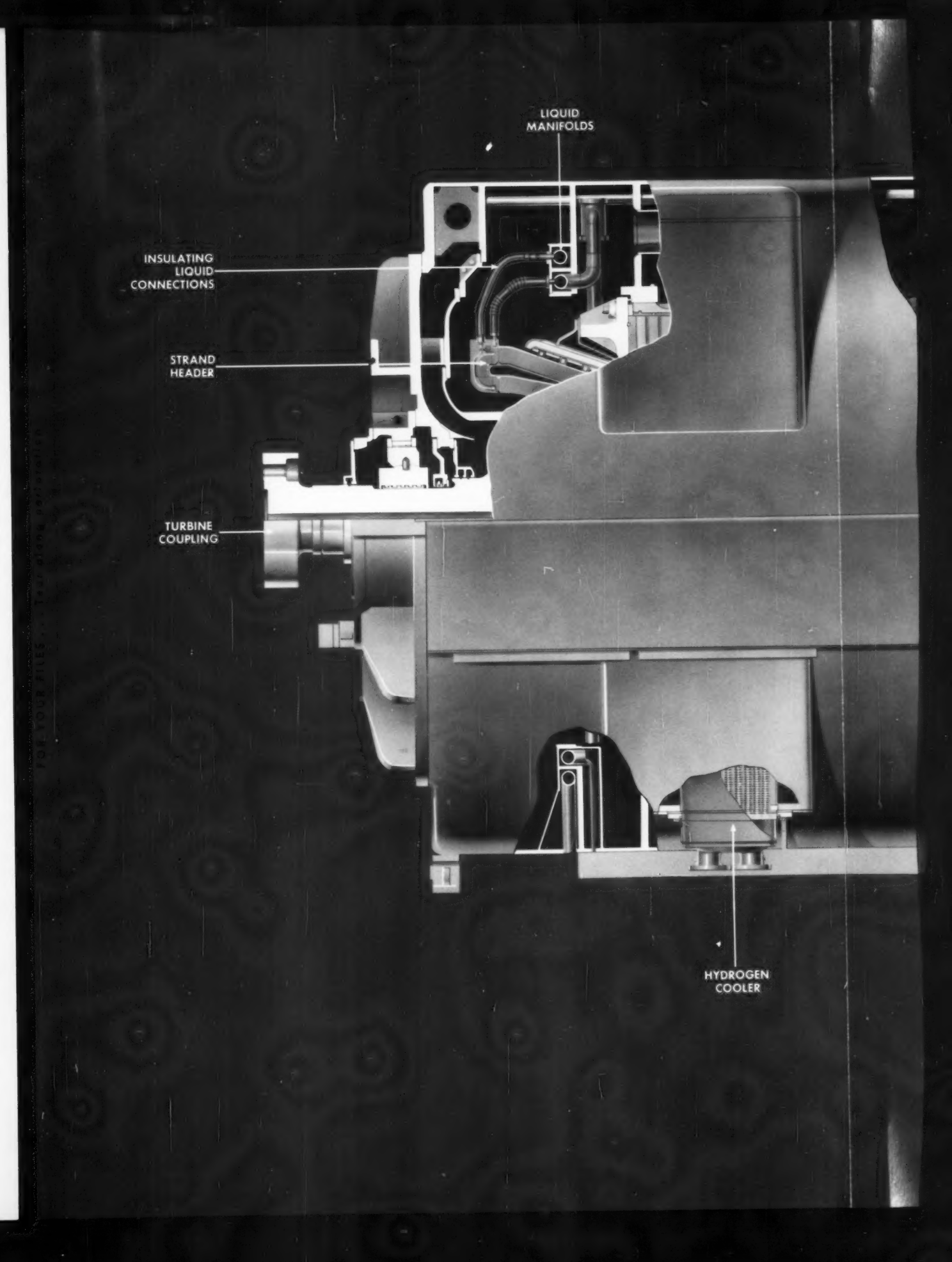
The new relay equipment replaces a conventional dc pilot-wire scheme which protected the three-terminal line. Need for a new approach arose when the telephone company made changes in the pilot-wire circuit which increased its loop resistance to 3,000 ohm and brought about unsatisfactory relay operation. Approaches available to Union Electric were a microwave channel, power-line carrier on the line, rerouting of the existing pilot-wire relay circuit, or the new microwave accessory equipment modified slightly for pilot-wire application.

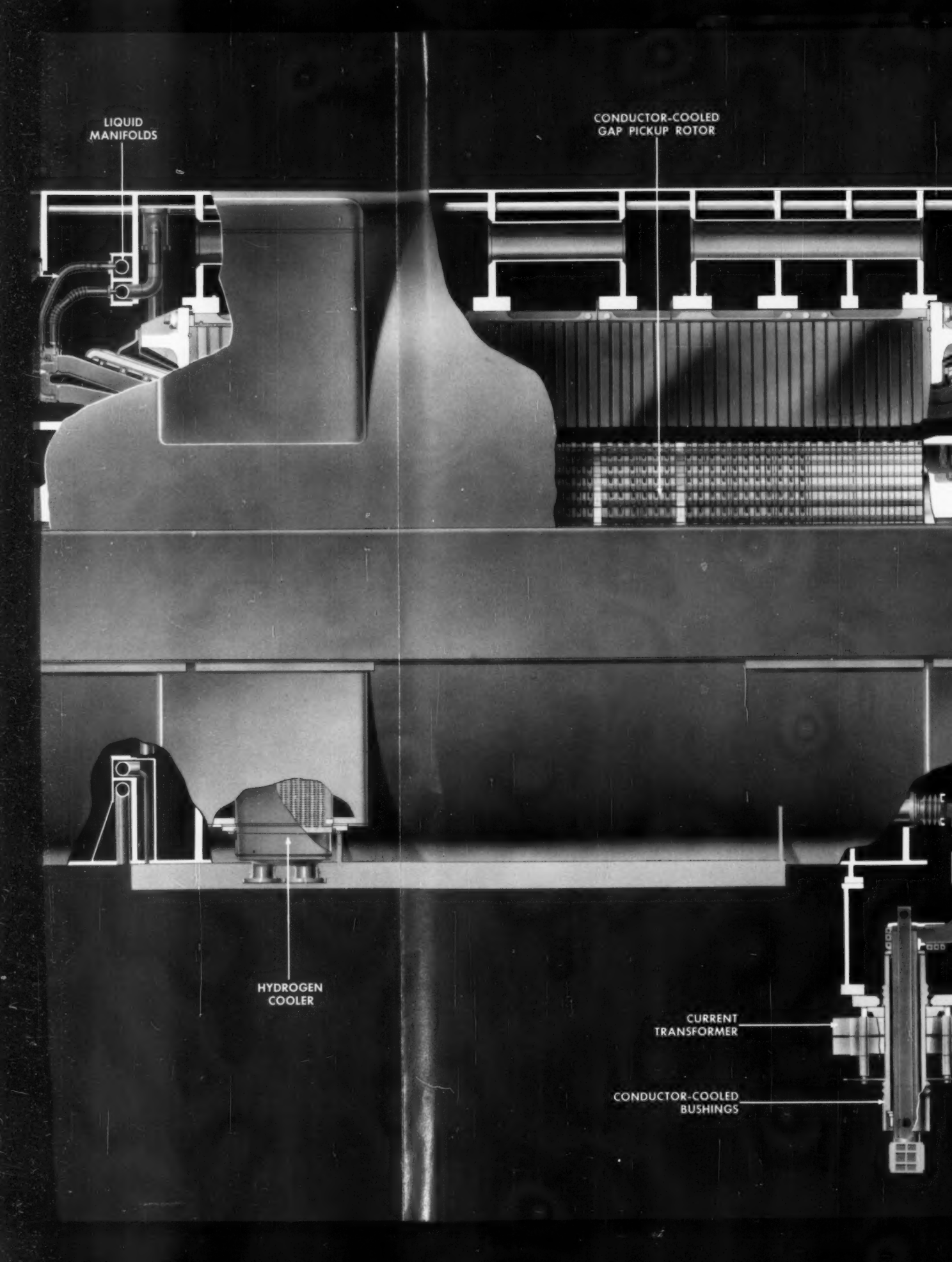
New microwave installations are hard to justify economically when only one or two relay channels are required over short distances in urban areas. And power-line carrier spectrums already were "overcrowded". Past experience with pilot-wire relaying revealed that rearrangement of leased-line facilities can lengthen the circuit so that relaying is no longer reliable, or marginal at best. In addition, spurious voltages, cross-talk, and interference voltages contribute to false operation. Thus the choice went to the new equipment, not only to solve the immediate problem of protecting the three-terminal line, but also to overcome difficulties experienced with conventional pilot-wire schemes.

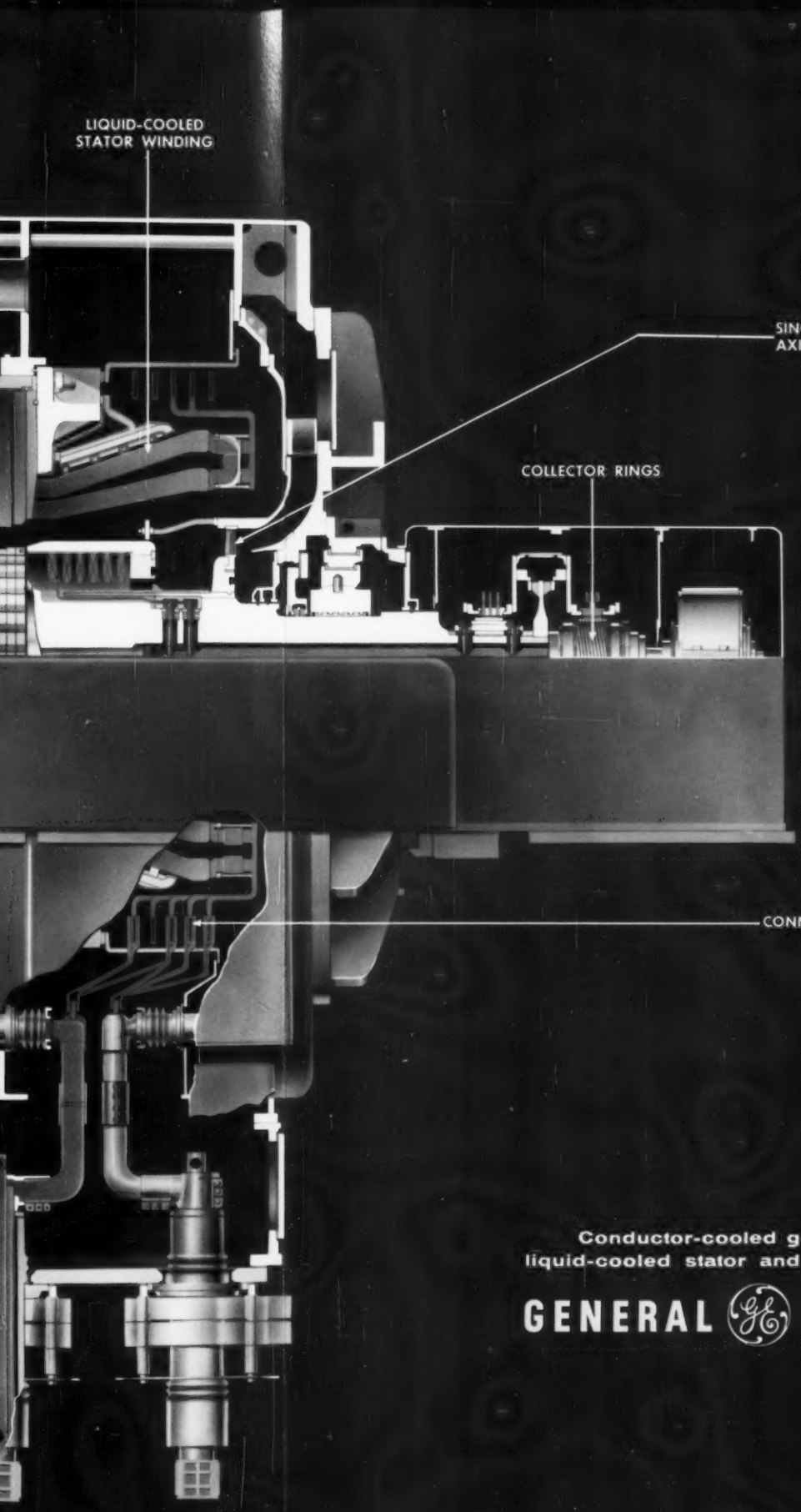
The audio-tone equipment requires one set of transmitter and receiver at each end of the line and two sets at the end of the tap. A 600-cycle bandwidth requirement for each tone under "normal-shift" conditions permits use of only two carrier frequencies, 1,600 and 2,450 cps, on a leased-wire facility. This does not create a serious disadvantage because signal input levels are kept below zero dbm and frequencies may be repeated at the same location.

In applying the new equipment to the leased line, the limiting factor was line loss of 40-50 db. Although loop resistance of the telephone circuit was increased from 2,000 to 3,000 ohm, impedance presented to audio frequencies is such that line loss is less than 40-50 db. As a

(*Continued on page* 65)


LIQUID MANIFOLDS
INSULATING LIQUID CONNECTIONS
STRAND HEADER
TURBINE COUPLING
HYDROGEN COOLER


LIQUID MANIFOLDS
CONDUCTOR-COOLED GAP PICKUP ROTOR
HYDROGEN COOLER
CURRENT TRANSFORMER
CONDUCTOR-COOLED BUSHINGS



Conductor-cooled generator with
liquid-cooled stator and gas-cooled rotor

GENERAL ELECTRIC

LIQUID COOLING

. . . key to higher generator ratings

The successful application of liquid cooling to generator stators has ushered in a new era in the design and construction of large turbine-generators. No longer is the stator winding thermal barrier the primary determinant of size and rating. Now, the door is open to generator designs conceivably as high as 1,000,000 kva!

With almost double the rating now possible within the same frame size, significant savings in power plant construction costs can be realized. In addition, higher-rated generators can be built and installed within the limitations on size imposed by shipping restrictions.

A high level of operating efficiency and reliability has been demonstrated by the commercial performance of General Electric liquid-cooled generators. And along with their many improvements, these units have retained the design simplicity and flexibility needed to meet individual operating requirements.

Some of the more important features which contribute to this outstanding performance are described on the following pages.

GENERAL ELECTRIC

GENERAL ELECTRIC'S DR. G. V. BROWNING AND C. H. HOLLEY DISCUSS FUTURE APPLICATION OF WATER COOLING

ON THE HORIZON . . . WATER COOLING

The successful application of liquid for cooling stator windings is progressing to even greater advances.

Up to the present, transil oil has been used as the coolant because of its high dielectric strength, good cooling properties, and its chemical inertness. Water, however, has over twice the heat removal ability of oil! It also has the advantages of non-flammability and availability. It is the most promising coolant for tomorrow's larger generators.

RELATIVE HEAT REMOVAL ABILITY OF COOLANTS

AIR	1.0
HYDROGEN 30 psi	3.0
TRANSIL OIL	21.0
WATER	50.0

Over two years of operational testing on the water-cooled generator simulative equipment shown above have proven that it is practical to maintain dielectric properties of water required for its use in large generators. Corrosion and erosion do not impose difficulties. Tests made to evaluate flashover and arcing showed that these characteristics would not present problems in a generator application.

Soon, when water cooling becomes an operating reality, generators can be built with ratings higher than are possible to attain today. This progress is still another example of how General Electric applied research is constantly looking to the future in an effort to meet utility needs of tomorrow.

Your nearest Apparatus Sales Office can furnish more details on liquid cooling and the development of water cooling. Or write for bulletins GER-1231 and GER-1478, Section 254-72, Large Steam Turbine-Generator Department, General Electric Co., Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric liquid-cooled generators offer improved performance, greater reliability

Despite the tremendous increase in unit output now possible with liquid cooling of generator stators, the design simplicity and reliability of conventionally-cooled machines has been retained. Units may be operated and maintained following standard practice. And better control of the unit under variations in load is possible. Here are some of the more outstanding design features of these generators:

MORE EFFECTIVE HEAT REMOVAL

In a liquid-cooled generator, the coolant flows directly through the tubular strands in the stator bar. This intimate contact between coolant and copper can remove up to 16 times as much heat as conventional methods . . . and does so with minimum temperature difference from copper to coolant. It also most efficiently uses stator slot space and simplifies stator bar internal insulation.

SIMPLE, RELIABLE DIELECTRIC SYSTEM

The dielectric system of liquid-cooled stators remains basically as simple as for conventionally-cooled machines. Completely insulated, the liquid connections between the stator bars and the manifolds leave no exposed copper or creepage surfaces. And, since no insulation is required between the coolant and the copper, the simplest dielectric construction of the stator bar is possible.

AUTOMATIC TEMPERATURE REGULATION

The liquid system permits generator load to be increased or decreased with minimum variation of stator winding temperature. Since the coolant is in direct contact with the copper, it cools the winding to within a few degrees of the liquid temperature. Therefore, by automatic regulation of the coolant temperature, average copper temperature can be kept essentially constant, practically eliminating thermal stress cycling on the insulation.

IMPROVED ROTOR ACCESSIBILITY

Since liquid cooling of the stator bars eliminates the need for multi-stage fans and complicated end shield assemblies, the short inspection downtime and low maintenance costs of conventionally-cooled machines is retained. Standard assembly and disassembly techniques may be used and normal time cycles are easily maintained.

CLOSED COOLANT CIRCULATING SYSTEM

Many unique features have been incorporated into the design of the closed coolant system to provide a permanently tight liquid circuit. The tubular strands which terminate at each end of the bar are joined by brazed connections; liquid connections to the manifold provide complete electrical insulation, mechanical flexibility and the long reliable life required for turbine-generator operation.

check against false operation from spurious noise, equipment was tested in the laboratory over artificial lines to which random-noise generators were connected. Test results indicate the equipment will not trip incorrectly due to noise.

The new equipment was installed on a three-terminal 138-kv line interconnecting Cahokia and Meramec steam plants and Watson Substation. Another three-terminal 138-kv circuit feeding this substation from the two plants is protected by power-line carrier equipment. It is believed maximum overall reliability will be provided by using power-line carrier for line No. 2 and the audio-tone leased-wire facility to protect line No. 1.

Distance Relays for Back-up

The Cahokia-Meramec No. 1 line and 138-kv tap to Watson substation are zone-protected by distance relays A, B and C, located at the three terminals as illustrated. Each zone overlaps in the area of the Mackenzie switchrack, where the 138-kv line is tapped to the substation. Audio-tone relaying, with a transmitter and receiver at each terminal, operates in conjunction with the distance back-up relays.

During normal operation, each transmitter continuously transmits a guard tone to its companion receiver. This tone is removed and replaced by a trip tone when a transfer-trip operation is indicated by the distance relays. Operation is on a frequency-shift principle. Receipt of a trip tone at a terminal will not cause tripping unless the guard tone is absent. Loss of both guard and trip tones will not produce false operation, but will lock out all receivers and initiate an alarm signal.

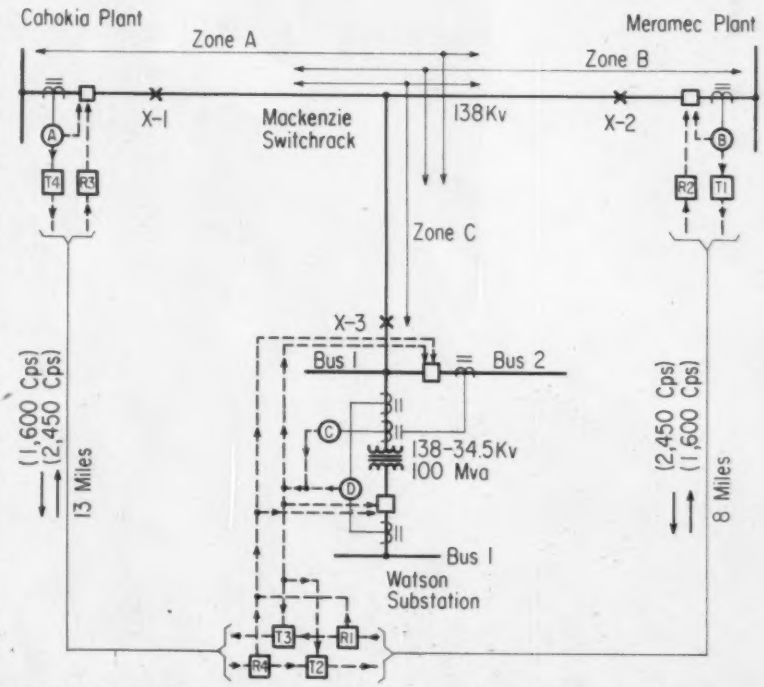
Guard and trip signals are designed to operate satisfactorily at signals of 8 db below normal signal level. Should system degradation fall to 6 db below normal level, a built-in signal alarm is energized. As a further safeguard, the guard tone must be restored for at least 200 millisec before the associated receiver will reset to trip.

Because Watson Substation is unattended, the alarm for loss-of-guard tone is sent by supervisory control to the load dispatching center at St. Louis over a leased wire. Reliability of this supervisory channel, which is over a somewhat different route than the audio-tone pilot-wire channel, is much the same as the pilot-wire channel. However, operation of the audio-tone relaying equipment also is supervised at both steam plants.

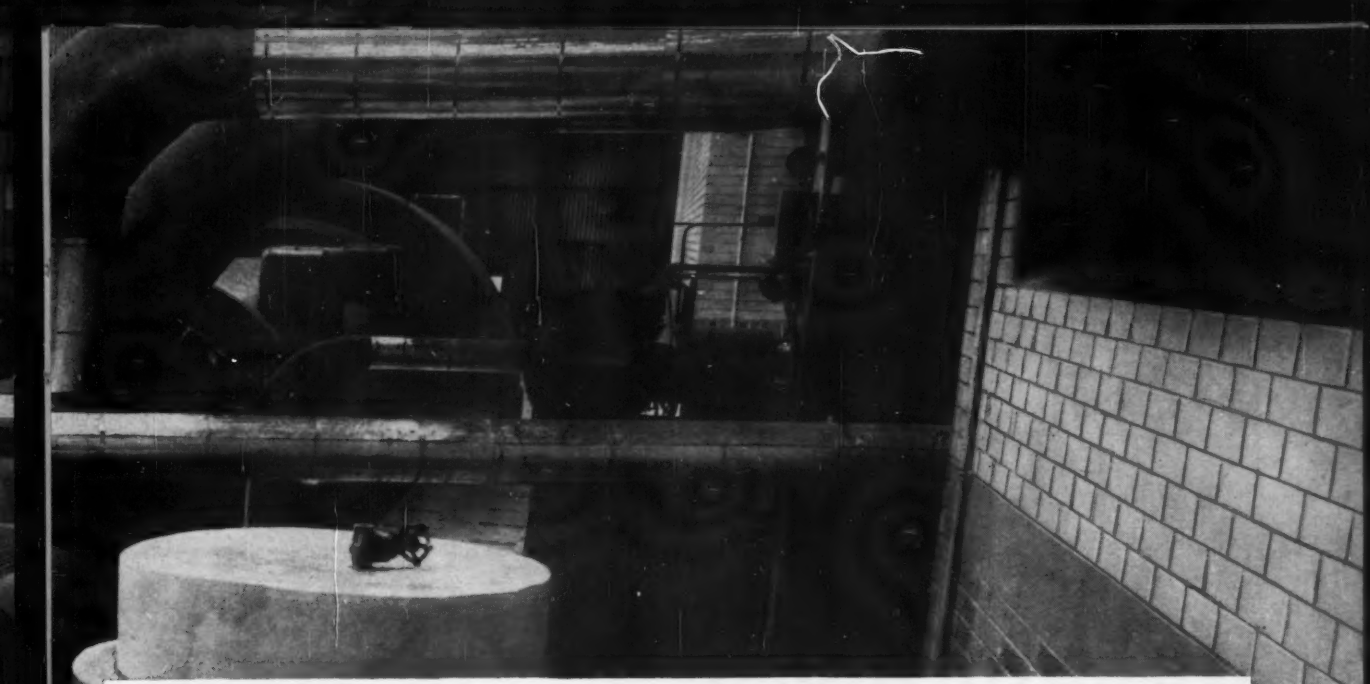
For an illustration of how the line is relayed, assume a fault at X-1 on the Cahokia-Meramec No. 1 line. This results in operation of distance relay A at Cahokia which, in turn, causes transmitter T4 to send a trip tone to its companion receiver R4 at Watson substation. Upon receipt of the trip signal, the receiver opens the Watson substation breakers through auxiliary relays and simultaneously keys transmitter T2 to receiver R2 at Meramec to transfer-trip at that terminal. Similarly, a fault at X-2 would cause a comparable sequence to take place, with receiver R1 tripping the Watson breakers and keying transmitter T3 for clearing the line at the Cahokia terminal.

For a fault at X-3 at Watson substation, tripping is initiated by distance relay C or transformer differential relay D. Transmitters T2 and T3 simultaneously transmit their respective trip tones to companion receivers at Cahokia and Meramec for transfer-tripping of breakers at those terminals. Tripping by relay C or D is distinguished at Cahokia and Meramec by the fact that D produces lockout and a continuous shift of transmitters T2 and T3. A shift at receivers R2 and R3 which persists for more than 12 cycles locks out terminals at both steam plants.

During transfer-trip operation, relay contacts which actuate the tone transmitter remain closed for about 4 cycles. The remote-receiver tripping contacts operate the seal-in relay within 2 cycles. However, a safety factor has been built into the equipment to assure proper pull-in and drop-out characteristics in the receiving relay contacts. These characteristics permit the receiving relay to remain closed for as long a period as the sending contacts are closed. This feature also is incorporated in the relay repeat at Watson substation. Operational tests have been completed on the audio-tone pilot-wire circuit for the Cahokia-Meramec-Watson line. Work has been started on a similar tone-relay scheme for other 138-kv circuits.



TRANSFER-TRIPPING of Meramec breaker for fault at X-1 is signalled by transmitter T4 through receiver-transmitter set at Watson to receiver R2. Breakers at Watson are tripped by the same signal from transmitter T4 to receiver R4



General Electric boiler feed pump turbine

INCREASES PLANT CAPACITY 2%

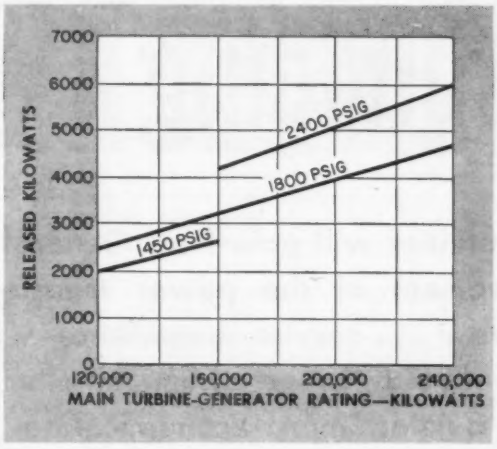
at AGE System's Glen Lyn plant

This G-E turbine driven boiler feed pump, in operation since May 1957, releases more saleable kilowatts for the Appalachian Electric Power Co. of the American Gas and Electric System.

The net output of the 225,000 kw Glen Lyn station unit number 6, operating on a 2000 psi reheat cycle, was increased by two per cent with the elimination of electric power requirements for the boiler feed pump drive.

Customer confidence in the reliability of G-E mechanical drive turbines is demonstrated by the selection of such equipment for this important application. This boiler feed pump drive turbine helps furnish profitable power for the equipment of the generating system.

Ask your nearby G-E Apparatus Sales Office about the dependability of General Electric turbine drives for your boiler feed pumps—or write Section 241-12, General Electric Co., Schenectady 5, N. Y.



SALEABLE KILOWATTS are released by the elimination of electric power needs with G-E high-speed turbines for boiler feed pump drives.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Progress That Pays Off . . .

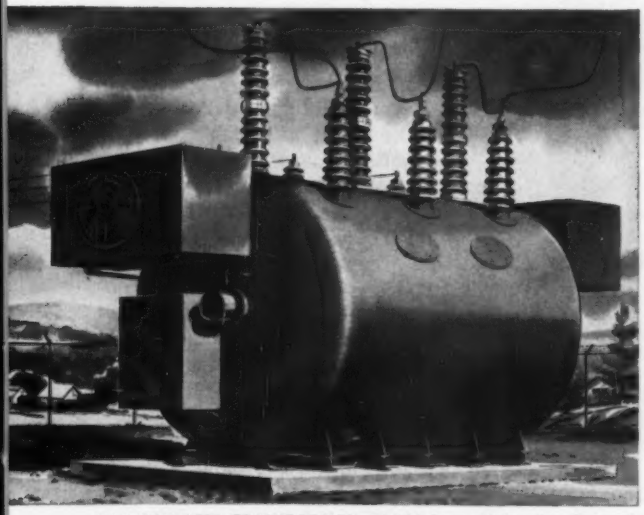
Five gas-insulated transformers already shipped or building

More utilities will gain from General Electric's development of the power transformers of tomorrow . . . service experience with these units should prove them smaller, lighter, safer, quieter, more economical to maintain.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FIRST GAS-INSULATED TRANSFORMER (above) was shipped to Consolidated Edison of New York, Inc. in 1956. One of two identical 2000-kva, 69-kv units for installation in metropolitan New York, it signalled what may well be a new era in power transformer progress. Here J. W. Seaman (right), General Manager of General Electric's Power Transformer Department and G. Camilli, Supervisor of Advance Product Engineering, inspect unit on test in General Electric Sound Laboratory at Pittsfield, Massachusetts.



GAS-INSULATED TRANSFORMER, 10,000 kva, 69 kv, for Pennsylvania Power & Light Company, will incorporate many of the design advances made in just the past few months.

General Electric is now building three gas-insulated transformers for these pioneering utilities: a 9375-kva, 69-kv load-tap-changing unit for Houston Lighting & Power; a 7500-kva, 46-kv LTC unit for Detroit Edison; and the Pennsylvania Power & Light unit shown at left.

Progress pays off in extra value for you. As these units enter service, we're confident utilities will find them ideally suited to substation applications in growing urban and suburban areas. Here's why:

Quieter. Gas, unlike oil, is compressible, transmits far less sound to tank.

Safer. Sulfur hexafluoride is non-flammable, eliminating need for costly vaults and fire extinguishing systems. SF_6 is non-toxic and odorless.

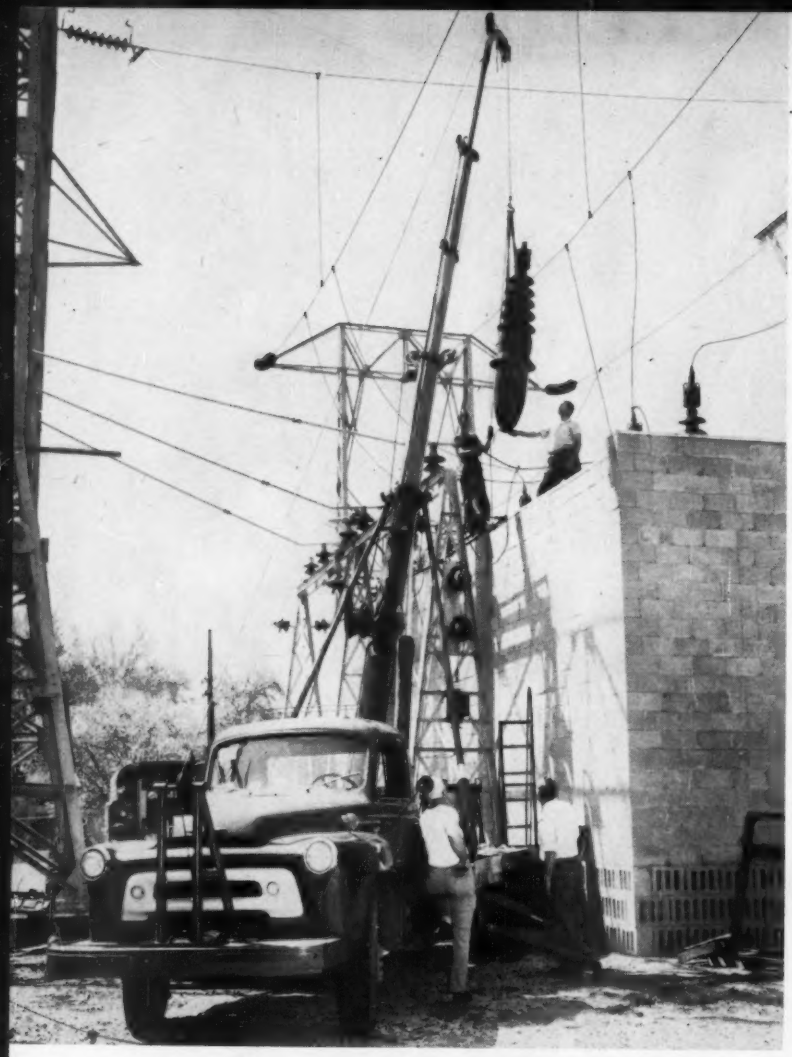
Easier to handle. No liquid storage or handling problems. Gas-insulated transformers are 20–30% lighter than liquid-filled units, simplifying installation and station construction.

Savings multiply. Above advantages mean units can be located in congested areas—even inside buildings. Result: Better utilization of space; shorter secondary bus runs.

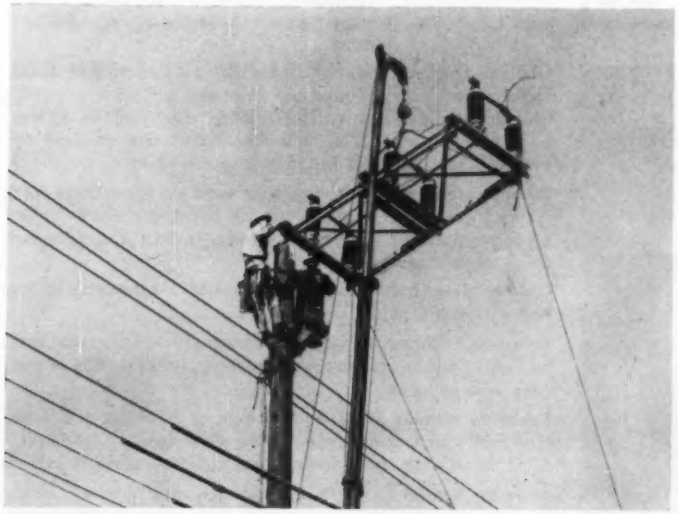
For details, contact your nearest G-E Apparatus Sales Office, or write General Electric Co., Schenectady, N. Y. 422-42

Boom and Platform Speed Jobs

Hydraulic unit saves $5,769 in five months for Indianapolis Power & Light Co. Precision control means safe, fast movement of boom



Rebuilt 1,200-lb 138-kv bushing is raised over a wall for installation in a transformer, and . . .



Assembled 34.5-kv airbreak switch and platform are raised 55 feet to the top of the pole

Hydraulic boom and an aerial platform attachment have saved Indianapolis Power & Light Co an estimated $5,769 in five months. At this rate the equipment will save enough to pay for itself in 18 months.

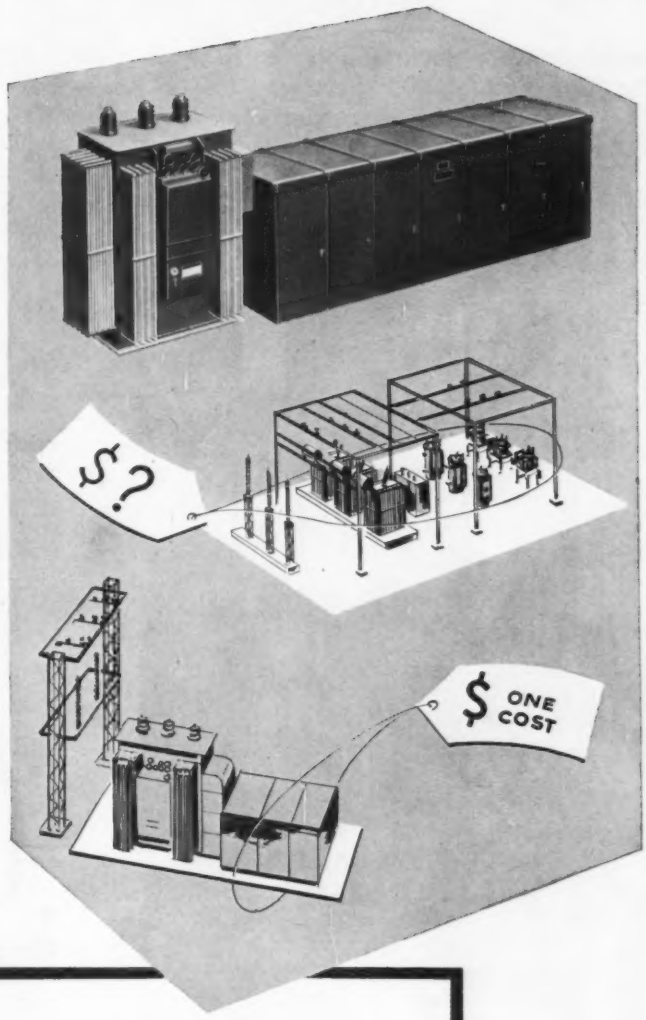
In the past a 20-ton crane was a favorite tool among a variety of methods for substation work. One shortcoming of the crane was the time required to get it to the job, set it up for work, take it down and move it to another location in the substation, and finally, take it down for return to headquarters. Also, it did not feature precision control. With the advent of the hydraulic boom, the crane is kept busy on jobs requiring its greater lifting capacity and for which it is better suited in other ways.

Several features make the hydraulic boom a valuable piece of equipment for use in substations. It has precision control, will reach up to 60 ft, can be retracted or extended quickly and easily, and has a lifting capacity in the vertical position of two tons. Hydraulic controls for the boom are on the left side of the truck behind the cab. From this location the operator has an unobstructed view of the boom at all times.

In substations, the necessity of working in close proximity to energized conductors makes precision

(*Continued on page* 72)

Packaged unit substations mean packaged costs



YOU KNOW WHAT YOU PAY FOR SUBSTATIONS when you purchase them as factory-built units. All equipment costs are billed to you against one order number, making cost control easier and helping eliminate hidden costs. For instance, you rid yourself of warehousing, inventory, and expediting charges. You also avoid the higher cost of processing a number of separate orders. General Electric Co., Schenectady 5, N. Y.

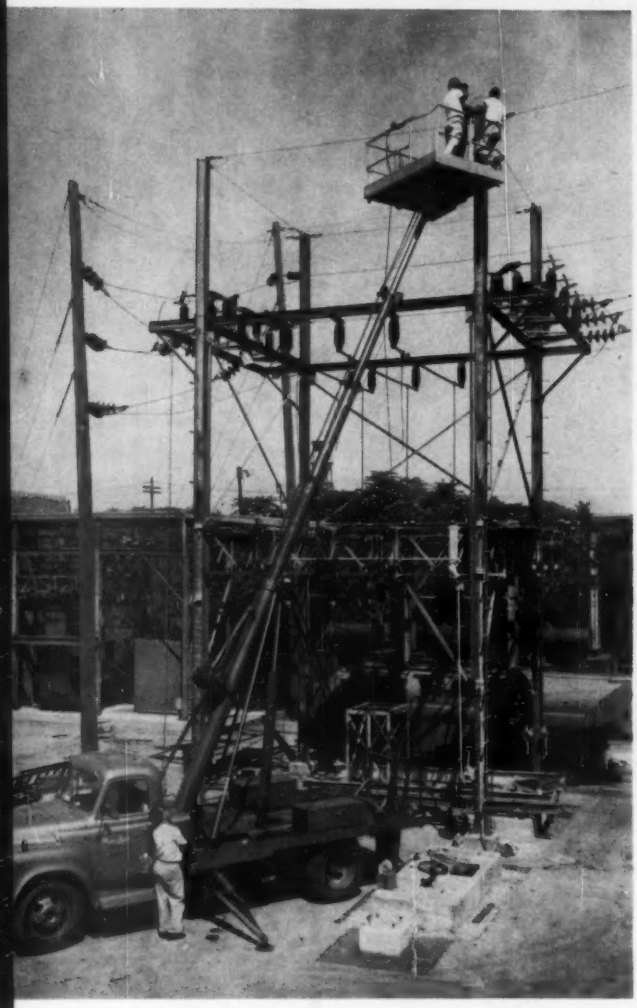
512-24

Progress Is Our Most Important Product

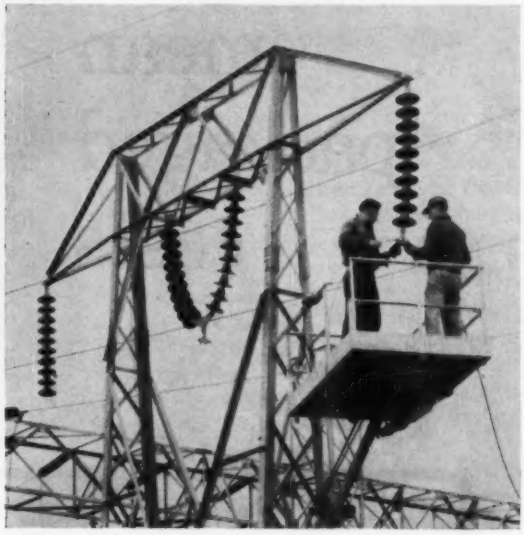
GENERAL ELECTRIC

Boom and Platform (*Continued from page* 70)

Aerial platform elevates workmen to dead-end static wire on 40-ft structure . . .



Positions men 6 ft from structure at 55-ft height to handle bus deadend clamp, and . . .



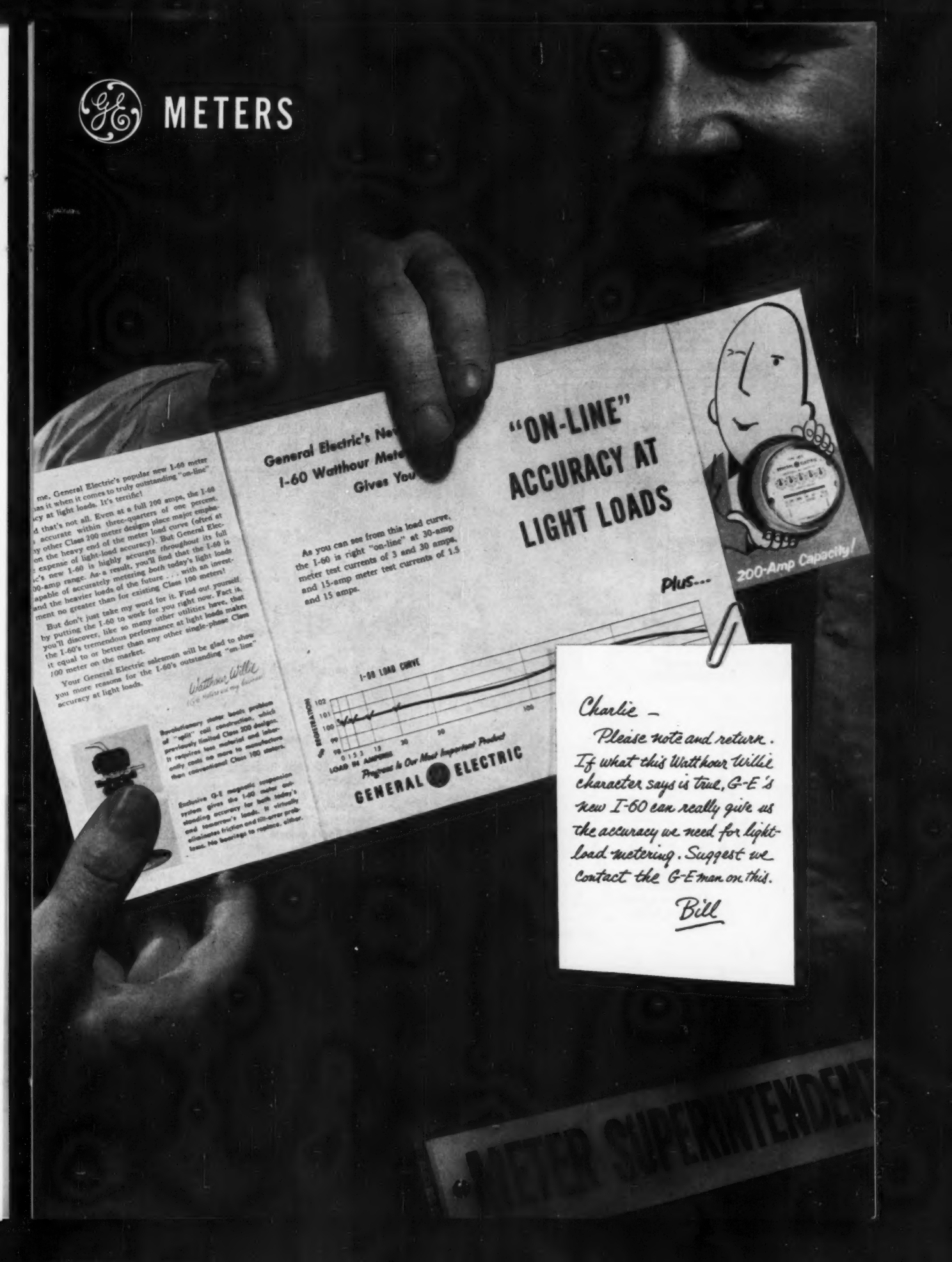
Raises men to work safely and easily on clamp fitting on insulator string

control important. Installation and removal of bushings, CT's, arresters and other equipment are handled more quickly than before because of precision control. The unit can be moved quickly for use first on one side and then on the other side of the substation.

The 4x6-ft self-leveling platform elevates and positions men next to the work with maximum ease. The platform is used for such jobs as deadending conductors of 138-kv circuits on substations structures, making flying taps on high-voltage buses, and installing, removing or working on pot heads. One job that would have required three weekends to complete under the former method was completed in one weekend with the aerial platform on the boom. The platform is large enough to permit work on two pot heads at a time.

The hydraulic boom also has saved time during installation of gang-operated pole-top switches. The boom raises the assembled switch and positions it accurately. Difficulties of assembling the switch at the pole top and aligning parts are eliminated. Compared with the use of the 20-ton crane for these installations, savings with the hydraulic boom are $95 per switch.

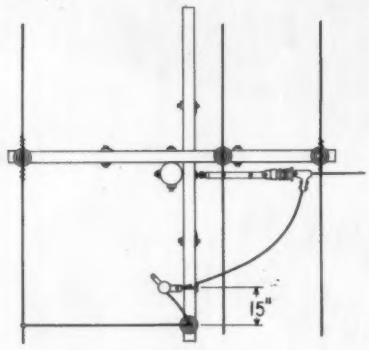
The hydraulic boom and aerial platform handle jobs previously done from hook ladders or from very long (40 ft or more) extension ladders. Work from the platform is much easier and faster. The boom and platform eliminate the need for scaffolding. For the installation of pot heads at one substation, an estimated $392 was saved and the job was completed much more quickly than it could have been done otherwise.

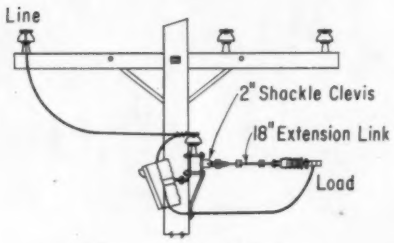

METERS
General Electric's Ne
I-60 Watthour Mete
Gives You
"ON-LINE" ACCURACY AT LIGHT LOADS
me. General Electric's popular new I-60 meter
as it when it comes to truly outstanding "on-line"
cy at light loads. It's terrific!
d that's not all. Even at a full 200 amps, the I-60
accurate within three-quarters of one percent.
y other Class 200 meter designs place major empha-
on the heavy end of the meter load curve (often at
expense of light-load accuracy). But General Elec-
c's new I-60 is highly accurate throughout its full
0-amp range. As a result, you'll find that the I-60 is
apable of accurately metering both today's light loads
and the heavier loads of the future . . . with an invest-
ment no greater than for existing Class 100 meters!
But don't just take my word for it. Find out yourself
by putting the I-60 to work for you right now. Fact is,
you'll discover, like so many other utilities have, that
the I-60's tremendous performance at light loads makes
it equal to or better than any other single-phase Class
100 meter on the market.
Your General Electric salesman will be glad to show
you more reasons for the I-60's outstanding "on-line"
accuracy at light loads.
Watthour Willie
Revolutionary stator basic problem
of "split" coil construction, which
previously limited Class 200 designs.
It requires less material and labor-
only costs no more to manufacture
than conventional Class 100 meters.
Exclusive G-E magnetic suspension
system gives the I-60 meter out-
standing accuracy for both today's
and tomorrow's loads. It virtually
eliminates friction and fifth-over prob-
lems. No bearings to replace, either.
As you can see from this load curve,
the I-60 is right "on-line" at 30-amp
meter test currents of 3 and 30 amps,
and 15-amp meter test currents of 1.5
and 15 amps.
I-60 LOAD CURVE
% REGISTRATION
102
101
100
99
98
0 1.5 3 15 30 100
LOAD IN AMPERES
Progress Is Our Most Important Product
GENERAL ELECTRIC
Plus...
200-Amp Capacity!
Charlie –
Please note and return.
If what this Watthour Willie
character says is true, G-E's
new I-60 can really give us
the accuracy we need for light-
load metering. Suggest we
contact the G-E man on this.
Bill
METER SUPERINTENDENT

Disconnect Switch Installations—2.4 to 12.4 Kv

Methods shown for installing disconnecting switches on 2,400 through 12,470-v, single and 3-phase circuits, adapted from Distribution Specifications of West Penn Power Co.

Installation on Single-Phase Circuits

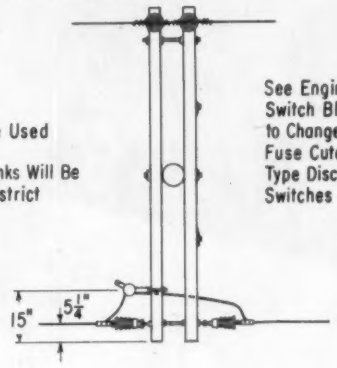


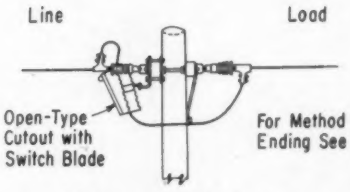


Disconnect Switch in Branch

Cutouts May Be Used If Necessary Size of Fuse Links Will Be Specified By District Engineer

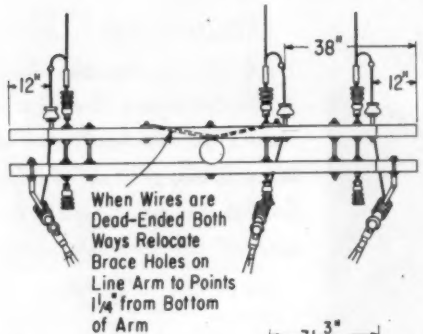
See Engineer for Switch Blades Needed to Change Open-Type Fuse Cutouts to Open-Type Disconnecting Switches

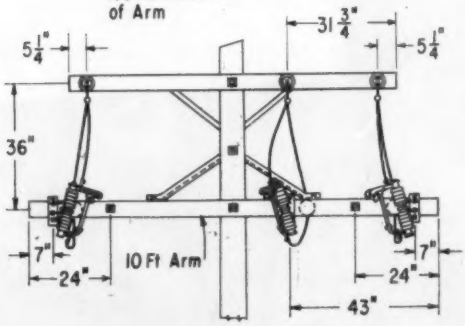




Disconnect Switch in Line

Installation on Three-Phase Circuits



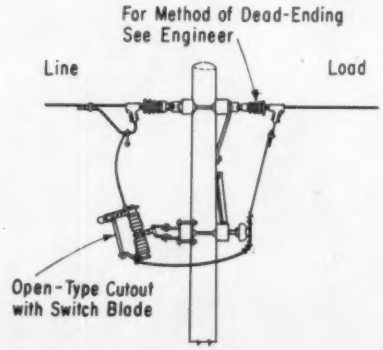


Notes:

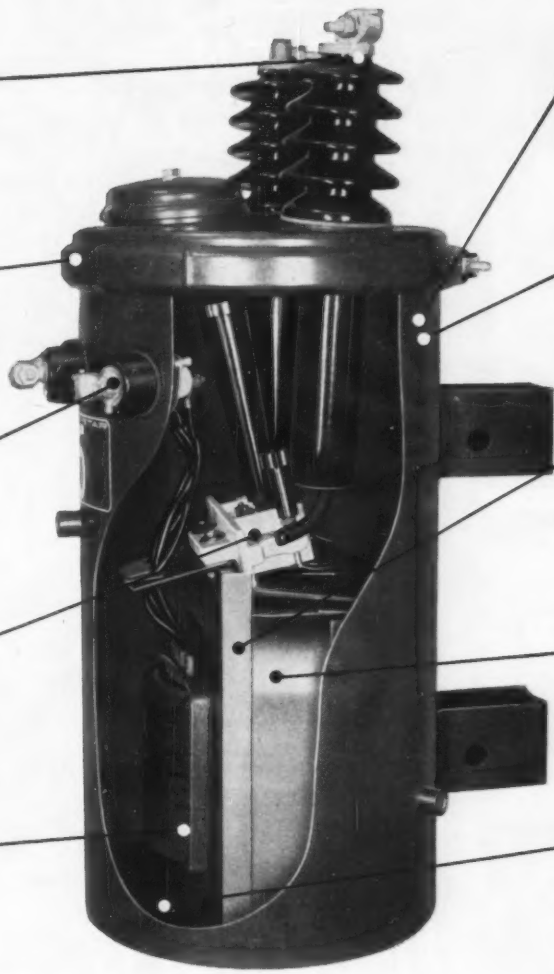
Blades for Changing Open-Type Fuse Cutouts to Disconnecting Switches. For 7.8 Kv 100 A Cutout Use 200 Amp Blade and for 7.8 Kv 200 A Cutout Use 300 Amp Blade.

If Fusing is Required, Use Fuse Tube Instead of Switch Blade. Size of Fuse Links will be Specified by District Engineer.

Load Break Cutouts may be Used if Necessary.



HERE'S HOW DELTA-STAR DISTRIBUTION TRANSFORMERS*



BUSHINGS

Double-keyed—connector to porcelain—porcelain to tank. Assures positive lock against rotation.

COVER

Assures positive seal—and natural shedding of water. One-piece non-corrosive clamping band with re-usable nitrile rubber gasket.

TERMINALS

Tin-plated bronze alloy. Spring loaded to accommodate aluminum or copper conductors.

TAP CHANGER

Positively positioned. Liberal voltage-creepage distance. Handle grip above oil. Shorting bar under spring tension.

COIL

Wound with liberal insulation. Heavy Formvar wire. Ducts provide maximum, uniform cooling.

TANK

Design minimizes number of external parts. Pressure-tested for perfect sealing. Reinforced bottom edge.

FINISH

Provides maximum corrosion-protection. Special metal preparation prior to alkyd painting. All primer and finish coats baked.

CORE-COIL ASSEMBLY

Will not shift under severest handling conditions. Securely anchored to tank wall. Positively braced against short circuits.

PORTER CORE

Grain-oriented, cold-rolled silicon steel. Assures low losses, smaller tank, minimum weight.

INHIBITED OIL

Gives extended life with better insulating characteristics. Specially processed immediately before filling.

With single phase ratings from 3kva to 167kva, in standard voltages through 15,000 volts, this complete line of Delta-Star Transformers embodies the latest developments in transformer design . . . a pole type built to fully meet NEMA standards.

Send for 16-page illustrated catalog. **Write to Delta-Star Electric Division, H. K. Porter Company, Inc., 17th and Cambria Streets, Philadelphia 32, Pa.**

***PATENTS APPLIED FOR**

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

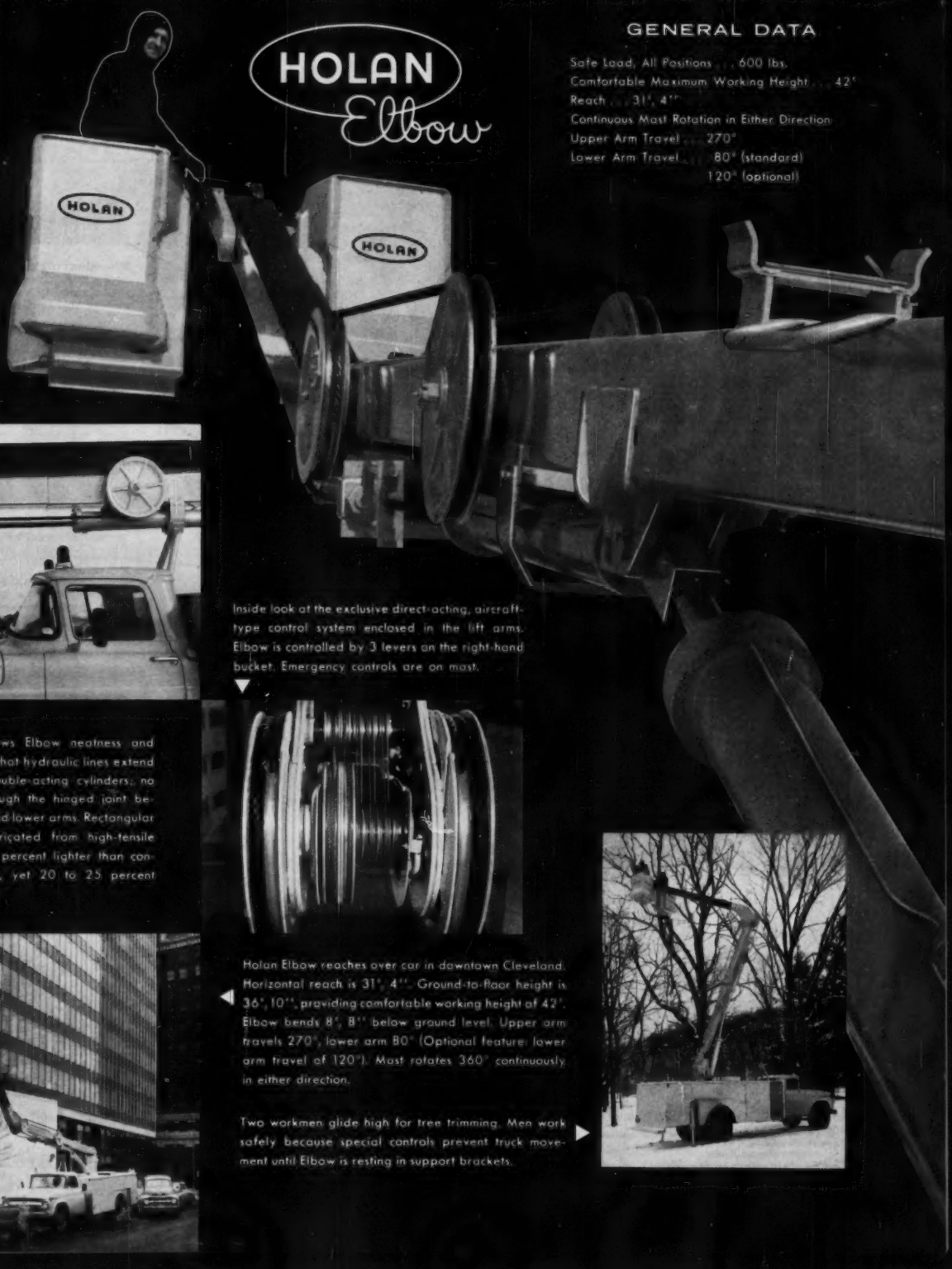
Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

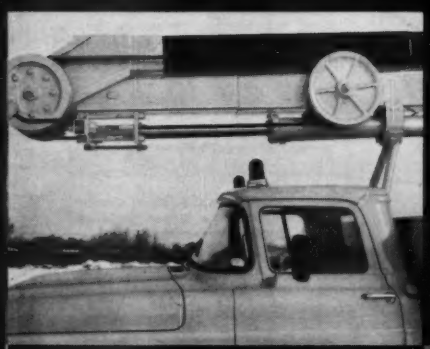
INTRODUCING

HOLAN Elbow

GENERAL DATA

Safe Load, All Positions . . . 600 lbs.
Comfortable Maximum Working Height . . . 42'
Reach . . . 31', 4"
Continuous Mast Rotation in Either Direction
Upper Arm Travel . . . 270°
Lower Arm Travel . . . 80° (standard)
120° (optional)





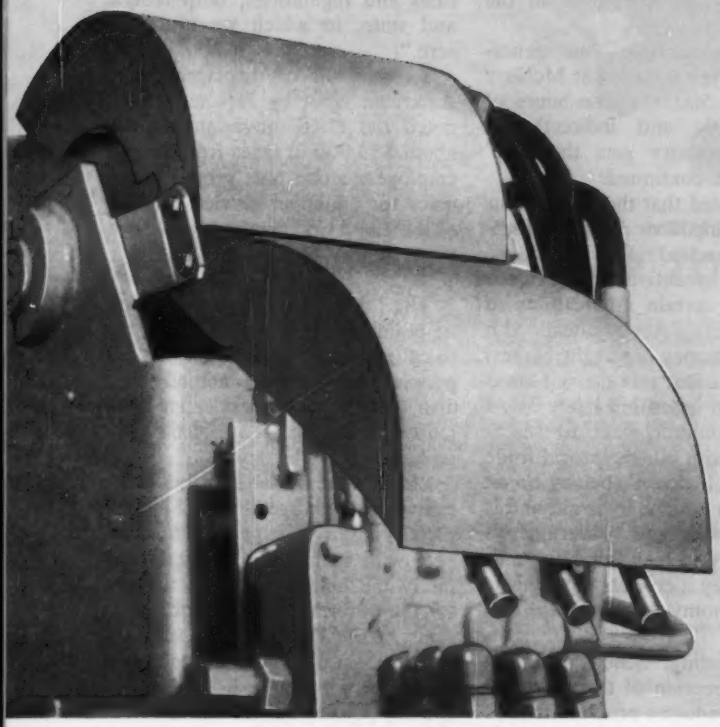
▲ Side view shows Elbow neatness and strength. Note that hydraulic lines extend only to the double-acting cylinders; no lines pass through the hinged joint between upper and lower arms. Rectangular lift arms—fabricated from high-tensile steel—are 20 percent lighter than conventional arms, yet 20 to 25 percent stronger.

Inside look at the exclusive direct-acting, aircraft-type control system enclosed in the lift arms. Elbow is controlled by 3 levers on the right-hand bucket. Emergency controls are on mast. ▼

◀ Holan Elbow reaches over car in downtown Cleveland. Horizontal reach is 31', 4". Ground-to-floor height is 36', 10", providing comfortable working height of 42'. Elbow bends 8', 8" below ground level. Upper arm travels 270°, lower arm 80° (Optional feature: lower arm travel of 120°). Mast rotates 360° continuously in either direction.

Two workmen glide high for tree trimming. Men work safely because special controls prevent truck movement until Elbow is resting in support brackets. ▶

.the first aerial elbow with cable-type control system



New Holan Elbow has aircraft-type cable controls for ease of operation and a minimum of maintenance

Three years in the development stage, the Holan Elbow is here — a double-armed, twin-bucket unit that reaches high and far with ease and safety.

It's easier to operate because of precise aircraft-type cable controls . . . easier to maintain because hydraulic lines extend only to the cylinders. This eliminates the usual 125 to 240 feet of hose and tubing — and eliminates oil leakage and the need for bleeding of lines. No special tools are ever required.

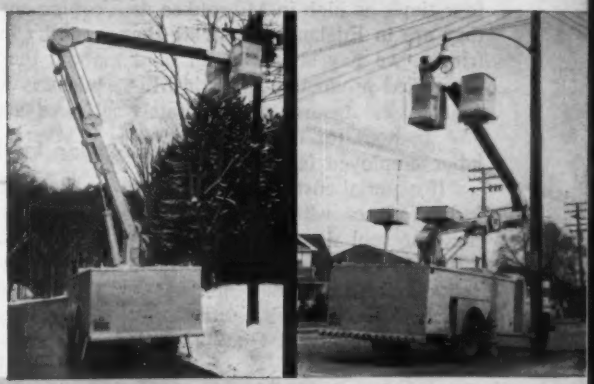
On these pages, you get a glimpse of the sound engineering and rugged construction that place the Holan Elbow in a class by itself. Look it over. Then, let us know when we can come out and tell you more . . . for instance, about how the Elbow is competitively priced.

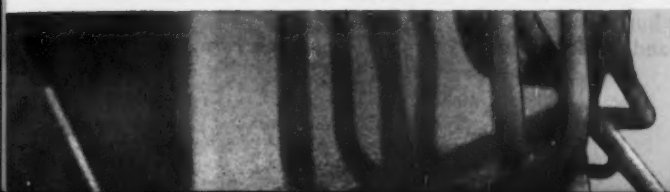
J.H. HOLAN® CORPORATION

4100 WEST 150TH STREET
CLEVELAND 35, OHIO

OTHER PLANTS: **HOLAN CORPORATION OF GEORGIA**, Griffin, Ga.
J. H. HOLAN CORPORATION, PHOENIX DIV., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION





Here, Holan Elbow speeds street light maintenance and construction work. Field uses include almost all overhead construction, inspection and maintenance. Twin work buckets—22" by 22" by 38" deep—are made of fiber-glass-reinforced plastic. Capacity: 600 lbs. Notice flare at bottom of buckets to provide more foot room.

Manufacturers Challenge U.S. Buying Policy

Power equipment manufacturers protest growing federal government purchases of major electrical apparatus abroad

A gathering storm of protests against government purchases of heavy power equipment abroad has been voiced in recent weeks by electrical manufacturers. Three most recent protests are by Allis-Chalmers Mfg Co, Lapp Insulator Co and General Electric Co. These are in addition to the formal testimony by National Electrical Manufacturers Association before the House Ways and Means Committee (EW, Mar. 3, 1958, p 70).

Allis-Chalmers Protests

Purchase of large quantities of heavy electrical apparatus abroad by the United States government was scored by Willis G. Scholl, executive vice president of Allis-Chalmers Mfg Co, in a recent talk before the Los Angeles Electric Club.

Scholl said that governmental divisions are inviting foreign bidders to come in and quote a low price for heavy electrical apparatus and walk off with the business.

Scholl pointed out that it takes as many man-hours to engineer and produce a hydraulic turbine, a generator, or a large transformer in Milwaukee, Wis., as in Europe. "At the same time," Scholl said, "the labor rates for both engineers and production people are three to four times as high in Milwaukee as they are in England. Including the fringes, we pay about $3 an hour for skilled production labor in Milwaukee as against approximately 75¢ an hour for the same type of labor employed in . . . England."

"If material costs about the same in both places, which it does, and if machine tool time cost isn't much different, and it isn't, the man-hours costs would wreck you," he said.

Scholl quoted a few statistics on man-hours involved. One hydraulic turbine order in 1956 represented the transfer of 600,000 man-hours of work from the $3-an-hour economy in which taxes were raised to the 75¢-an-hour economy in which the money was spent. That was a direct loss in turbine shops, but in addition it is estimated that about 250,000 other American man-hours were transferred from the steel mills, forge shops, etc., to those in the other country.

"Another example—one generator of the type installed at McNary Dam needs 500,000 man-hours of labor directly and indirectly in whichever country gets the job," the executive continued.

Scholl stated that the answer was not in reducing labor rates nor dropping our standard of living.

And the executive said, "For a little while, certain applications of the Buy America Act handicapped it (taking tax money out of the highest market) . . . But this doesn't seem to have been operating lately . . . I certainly wouldn't want to see it tangled up with our reciprocal trade matters, for it doesn't belong there. It belongs in a niche by itself, and is connected with our government's responsibility to play fair by spending the money it collects in the same kind of economy from which it collects it."

In concluding, Scholl said that with the exception of this electrical equipment industry problem that he couldn't feel anything but optimistic about the long term possibilities of business and for the future of the United States.

Lapp Insulator Appeals

Stepped up competition from Japanese-made porcelain insulators has resulted in recent vigorous protests from the insulator industry in the United States. Industry executives charged that recent purchases of Japanese manufactured insulators by federal power agencies on the Pacific Coast has hurt the American insulator market and created a situation which would be equivalent to unemployment of 70 men for 10 weeks.

A telegraphed appeal to members of Congress by Ralph L. Jenner and Brent Mills, president and executive vice president, respectively, of Lapp Insulator Co pointed out that Japanese insulators "are produced by labor which does not in any sense come under the innumerable rules and regulations, both federal and state, to which we must adhere."

As a result of displacement of American labor by Japanese, Mills noted the U. S. government loses about $13,000 in taxes from Lapp's employees alone plus proportionate taxes for employer services outside of the Lapp organization.

Japanese Labor Cheaper

The total pay of Japanese labor, he pointed out, is less than half the so called "fringe benefits" which our people enjoy and is actually less than 10% of our labor cost per hour. (Japanese workers are paid 18¢ an hour for a 9-hr day.)

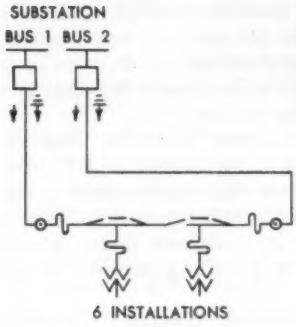
"It is unreasonable," the Lapp executives charged, "and completely unfair to expect us to compete with such labor and it is certainly the height of destructiveness for the government, of all organizations in the United States, to take the lead in sponsoring such purchases."

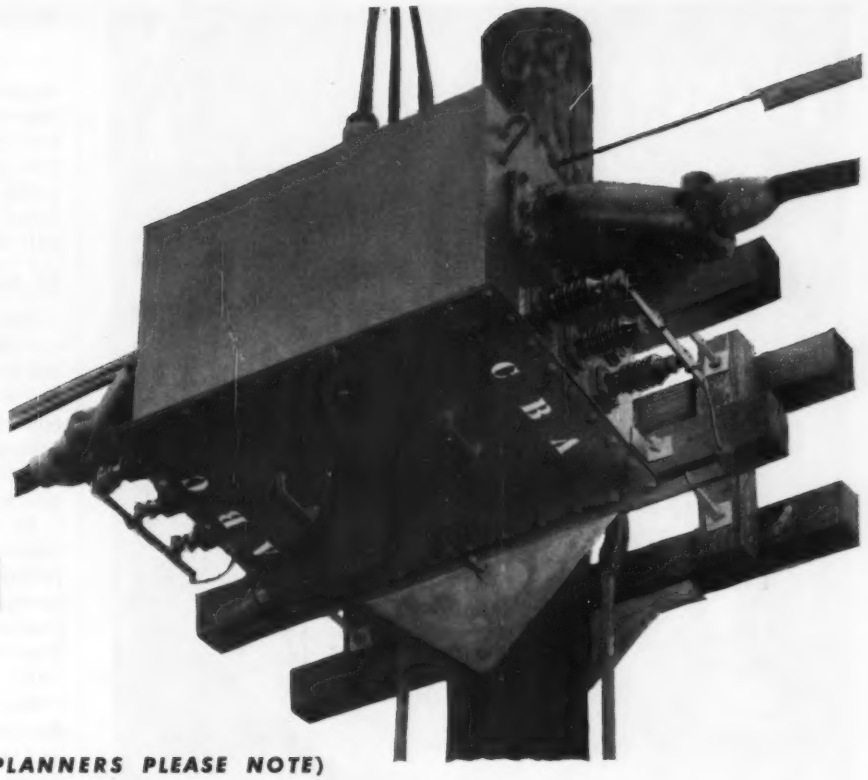
They pointed out the "unrealistic" low duties now in effect on high voltage electrical porcelain imported into the United States is responsible for the purchase of insulators from the Japanese.

They called attention to the fact that recent purchases of high voltage disc insulators have been made by federal power agencies from Japanese sources at prices ranging up to 14% under domestic manufacturers.

In one very recent purchase Bonneville Power Administration (Requisition #8657) bought 24,600

(*Continued on page* 80)





(SHOPPING CENTER PLANNERS PLEASE NOTE)

A SWITCH YOU LOOK UP TO

The compact G&W, Type RA (full load break) 400 ampere, 15kv sectionalizing switch shown above is one of six that played an important part in an interesting departure from conventional designs to serve the electrical needs of a midwestern shopping center. Each switch is mounted on a pole opposite a transformer structure. Aerial cable laterals from the transformer primaries terminate at the top of the switch. The dual-fed 12,000 volt primary line enters on one side and leaves on the other side of the switch.

Two rod-connected operating levers on each switch can be locked in one of four positions: test ground, on, off and transformer by-pass. Normally, the line is "open" (one lever is in the "on" and one is in the "off" position) at one of the sectionalizing switches and three transformers are fed from each circuit. A number of combinations make it possible to isolate a section of the primary line or a transformer without interrupting customer service.

Details of this shopping center installation are available by writing to G&W.

VOLTAGE CHARACTERISTICS

voltage rating	60 cycle withstand dry	impulse withstand 1½ x 40 wave
7.5kv	36kv	95kv
15.0kv	50kv	110kv
23.0kv	70kv	150kv
34.5kv	95kv	200kv

CURRENT CHARACTERISTICS

ampere rating	switch	amperes	
		momentary	4 seconds
400	standard	20,000	15,000
	special*	30,000	19,000
1000	standard	40,000	35,000
	special*	50,000	40,000

*silver inlaid contacts

The RA oil switch is unrivalled. Its flexibility puts it in a class of its own. Add to this the quality of materials and craftsmanship that go into it and you have a switch you look up to.

A design of the simplest type of oil switch to one having an unusual degree of flexibility can be adapted to your needs. Consult a G&W representative to help you decide which will best suit your plans.

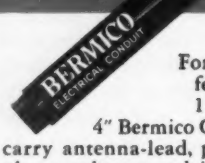
G&W ELECTRIC SPECIALTY COMPANY
3500 WEST 127TH STREET • BLUE ISLAND • ILLINOIS

D582

BERMICO® electrical conduit used at Pungo Naval Air Station

. . . because "it's light, strong, easily and quickly installed. Costwise there's no match for it," says M. J. Lehtio,

Branch Manager, Clarke Electric Co., Inc., Norfolk, Va.



Forty thousand feet of 2" and 15,400 feet of 4" Bermico Conduit will carry antenna-lead, power, telephone, teletype and intercommunication cables for the new Coast Guard radio installation at Pungo Naval Air Station, Norfolk, Va.

Bermico Conduit is precision engineered from cellulose fibre impregnated with coal tar pitch. It is uniform in quality, with smooth inside bore allowing easy cable pull-through without danger of abrasion. Highly resistant to acids, alkalies, heat, water and corrosion. Bermico is confidently used by leading electrical contractors on this and other government projects, knowing it surpasses Federal Specification W-C-581 by an ample margin.

On your next job why don't you use Bermico? Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

General Sales Offices: 150 Causeway Street, Boston 14, Mass.
Mills: Berlin, N. H.; Corvallis, Ore.

Manufacturers Challenge

(*Continued from page* 78)

suspension insulators from the Japanese for $75,772. Lapp's bid was $86,360, a difference of $10,588. The Japanese, Mills noted, bid a little more than 12% under published prices to insure success under the "Buy American Act."

GE Petitions ODM

Meanwhile in another related area the Office of Defense Mobilization has moved to investigate assertions by the General Electric Co that government purchases of heavy power apparatus abroad has been in such quantity as to threaten to impair the national security.

In a letter to ODM Director Gordon Gray, officials of GE have petitioned for a determination of the essentiality of heavy electrical power producing equipment under section 7 of the Trade Agreements Act of 1955.

Equipment concerned is that directly involved in the generation and transmission of large scale power. Such equipment consists of hydraulic turbines, turbine-driven generators, power transformers and power circuit breakers.

The company submitted the following four reasons to show that the continued importation of heavy power producing equipment from abroad threatens to impair the national security.

1. Domestically produced heavy power equipment has greater proven reliability.

2. It is essential that adequate repair and replacement facilities be available so that equipment can be promptly and expeditiously repaired and replaced when necessary. The domestic industry is well equipped and able to repair and replace equipment of its own manufacture; on the other hand foreign manufacturers lack adequate facilities for effecting major repairs. Moreover, because of fundamental differences in design, material and methods, domestic manufacturers can accomplish repairs on foreign made equipments only with difficulty.

3. In view of the relatively long manufacturing cycle required for this type of equipment, it is essential that the source of supply be such as will provide the greatest possible assurance that the equipment can

both be completed and delivered on schedule.

4. It is essential that a domestic industry capable of producing heavy power equipment remain intact and able to respond to calls for defense production in any emergency.

The company's concern largely relates to the purchase of heavy electrical power producing equipment by certain Federal agencies. GE states that the petition is not based on any alleged injury to the domestic industry. What is sought is an overall determination of the essentiality of heavy power producing equipment.

In addition to the determination the company requested ODM furnish appropriate advice to the Bureau of Reclamation, Corps of Engineers, Bonneville Power Administration, and Tennessee Valley Authority with respect to the essentiality of heavy power producing equipment under Section 3 (d) of Executive Order 10582 dated December 17, 1954. This prescribes uniform procedures for certain determinations under the Buy American Act.

A 15,000 Kva Transmobile Built by Penn Transformer

A mobile substation having a capacity of 15,000 kva, 64,400 volts, has been designed and built by Pennsylvania Transformer Div, McGraw-Edison Co, for a southwestern utility.

Known as the Transmobile, this power substation is believed to be the highest-rated electrical unit of this type made to date. The Canonsburg, Pa., manufacturer reports that although it has a high capacity, the mobile station meets all normal highway clearances.

This substation on wheels consists of a transformer with a circuit breaker, lightning arresters, high voltage fuses and other auxiliary equipment.

U. S. Aluminum Production

Primary aluminum produced in the U. S. in March totalled 137,916 tons, according to the Aluminum Association, New York. The

(*Continued on page* 82)

PUT 'EM DOWN BY MACHINE to cut anchoring costs!

Many utilities have found that anchor installation time and costs can be cut to the minimum by installing Chance Screw Anchors with their hole boring machines. They use the Chance "Blackfoot" because its special features—correct blade pitch, small hub, large thimbleye—were designed for use with boring machines. These features also mean greater holding power and easier installation of these anchors when they are screwed down by hand.

the CHANCE "BLACKFOOT"*

*the line crew's name for the line crew's choice.

–King-size thimbleye accommodates big turning bar or boring machine adaptor.

–Smaller hub means less earth disturbed during installation. Adds to holding power.

–Blades are accurately "pitch-controlled" for fast-cutting, speedy installation.

Chance Screw Anchors are available in sizes from 4" to 15" in diameter. You can get them from stock from your anchor distributor.

. . . and there are CHANCE ANCHORS for all other soil and guying conditions . . .

CA58-5

A·B·CHANCE CO· CENTRALIA MISSOURI

(A·B·CHANCE CO. of Canada, Ltd., Toronto)

I wish we had more time
and personnel to prepare
for this rate case!

Your staff is
overloaded now.
Call in the specialists and
let them carry the peak load.
HOW ABOUT PIONEER?

GIVE YOUR NON-ROUTINE
OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 56 years. It designs fossil fuel, hydro and atomic plants. It forecasts load growth, selects sites, purchases and expedites equipment and supervises construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers services in all phases of Federal, State and Local regulation including rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting, tax counsel, insurance, and pension planning. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!

On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

56 YEARS

Pioneer Service
& Engineering Co.

231 South La Salle Street
Chicago 4, Illinois

Aluminum Production

(*Continued from page* 81)

amount is 12,314 tons more than produced in February and 2,210 tons more than in March, 1957. Total production for the first three months this year is 403,427 tons, up from 401,795 tons for the same period last year.

Apparatus and Industrial Group Formed by GE

An Apparatus and Industrial Group has been established by General Electric Co, according to Robert Paxton, president. Concurrently, Arthur F. Vinson, a vice president, was appointed to head the new Group, and John W. Balanger was appointed consultant to Vinson. The former was group executive of the Apparatus Group. Balanger was vice president and group executive of the Industrial Components and Materials Group.

GE has realigned the business, personnel and facilities of its former Air Conditioning Division into an operating department of the company's Appliance and Television Receiver Division. This was done to "increase our effectiveness in the air conditioning industry," said James H. Goss, vice president and group executive of the company's Consumer Products Group.

Union Carbide Makes 100% Reactive Silicone Resin

A 100% reactive silicone resin has been developed for electrical insulation applications. It is available from the Silicones Div., Union Carbide Corp, New York.

Designated XR-70, the resin reportedly eliminates the need for a solvent removal step during cure. This makes possible thick sections of void-free, corona-resistant, high temperature (180C) insulation. Low viscosity provides deep penetration and thorough impregnation of windings and coils of power equipment.

This resin is reportedly suited for vacuum impregnating form-wound coils with mica or glass cloth insulation for operation at Class H temperatures. Another use is for potting and encapsulation of devices.

UNIFORMITY

"VICTOR SUSPENSIONS—

NOT ONLY LOOK ALIKE—
THEY PERFORM ALIKE,"

says Robert L. Perry,
Factory Manager,
Victor Insulators Division,
I-T-E Circuit Breaker Co.

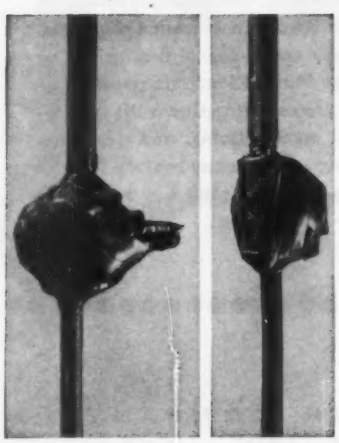
Why try to cut corners with suspensions whose mechanical and electrical characteristics may vary all over the lot? Be sure of uniformity with VICTOR Suspensions. They are made by the carload, year after year, yet each insulator is identical. Each has a built-in margin of safety that precludes failure on the line.

Big reason for this amazing uniformity is Purified Porcelain. This porcelain is denser, harder, stronger, has greater uniformity than any insulator porcelain ever made! Segregation and analysis of each shipment of raw material, scientific proportioning of ingredients, demineralization of all processing water and the use of densitizing pug mills make Purified Porcelain possible.

These processes together with quality-controlled manufacturing, and rigid, routine testing techniques make truly superior insulators. You just can't buy better suspensions—at any price!

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION
Victor, New York

New Alcoa 390-490 Series Extruded Parallel-Groove Clamps are More Compact, Easier to Apply



COMPETITIVE CLAMP

ALCOA CLAMP

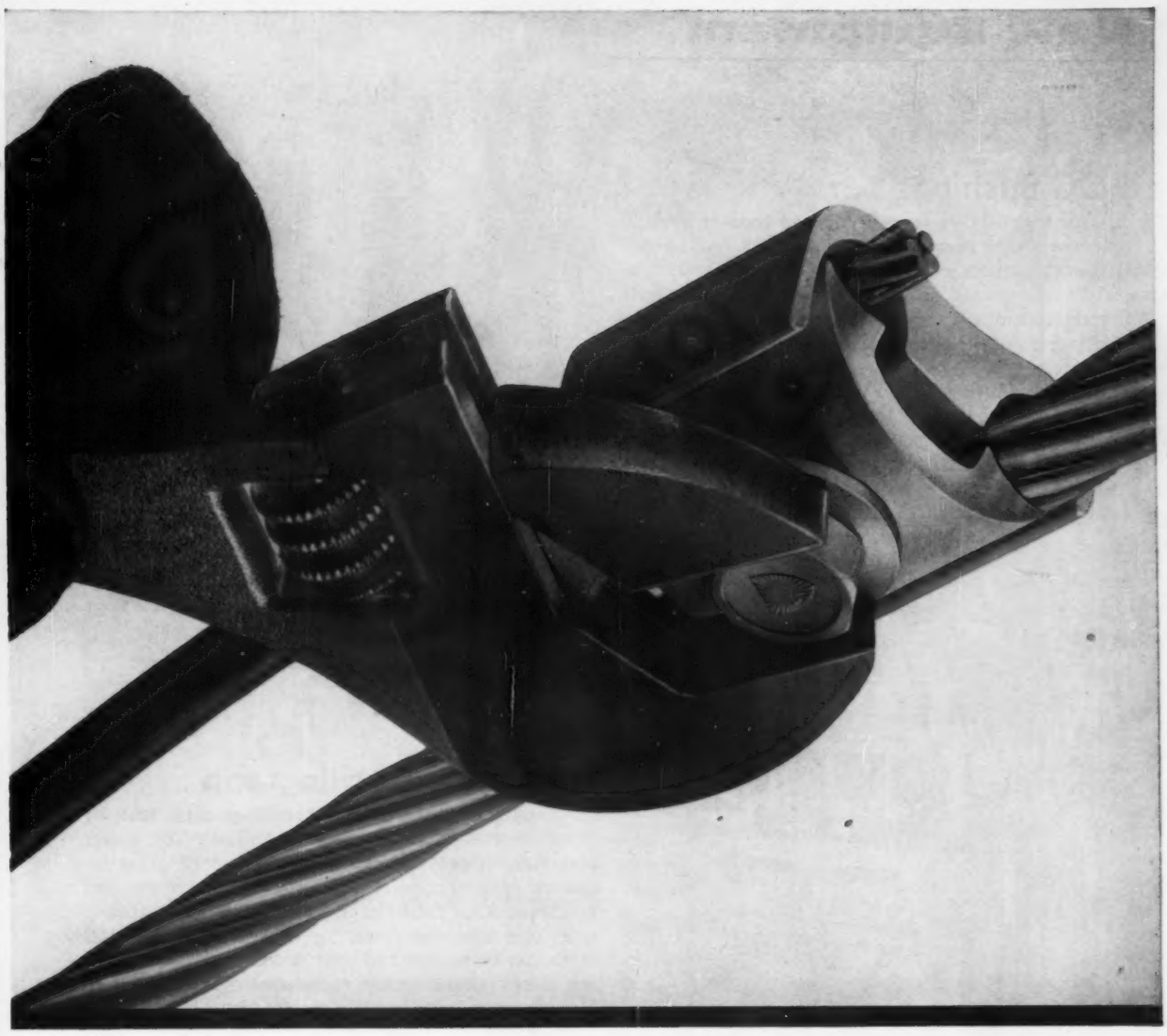
All loose parts eliminated... reduced bulk gives neater appearance

Now you can get the benefits of Alcoa's universal groove design previously announced for heavy-duty clamps. Two new Alcoa single-bolt, distribution and service-drop-type extruded clamps* accommodate ACSR and stranded aluminum sizes #6 to #2 7/1 (Catalog 490.0) and #6 to 2/0 (Catalog 396.6).

Top and bottom parts of the new clamps are Alcoa® Extrusions —made strong, solid and dense from heat-treated alloy. Grooves are specially treated and coated

*Patent applied for

REDUCED BULK in Alcoa's new 390-490 series clamps makes them easy to tape; gives a neat, more compact appearance on the line, makes them easier to store and handle.



to provide low-resistance surfaces. All parts are aluminum to equalize expansion, eliminate corrosion. The new extended lip prevents cap from turning when being applied.

Other benefits you get with these economical new Alcoa clamps are easier application and handling. Loose parts have been eliminated. These clamps can be applied "hot." Bolts are anodized to reduce thread friction. A supply of these clamps on your trucks will cover most distribution applications. Simplified ordering and stocking, and fast delivery, also save you money.

When you specify Alcoa parallel-groove clamps, you also buy the experience gained during a quarter of a century of manufacturing clamps and other accessories for aluminum . . . plus years of extensive laboratory testing. Ask your Alcoa representative to show you samples of these clamps. Call him today for full information, or write Aluminum Company of America, 2306-E Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure.
Alternate Monday Evenings

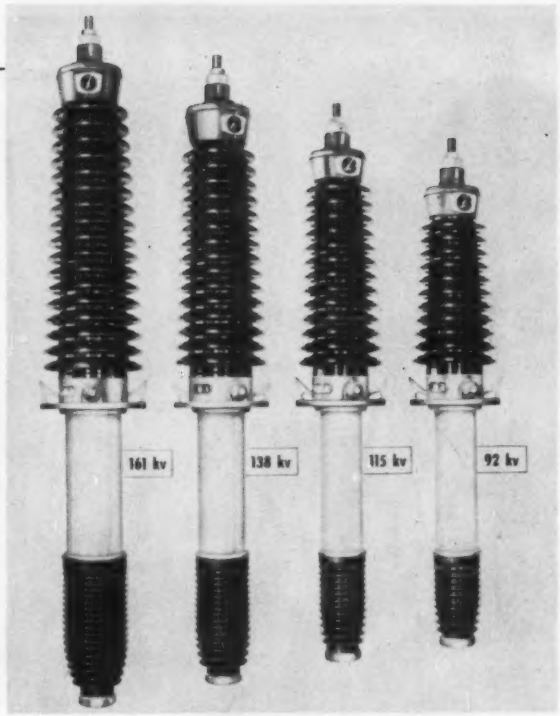
New Equipment

POC Bushings . . .

. . . for high voltage transformer and breaker applications are offered in ratings of 92, 115, 138, and 161 kv. Paper-oil condenser design has condenser coil completely surrounded in oil and enclosed in rugged, porcelain-metal housing. Lower end of core has non-tracking, corrugated porcelain housing which seals out moisture.

Bushings are radio and TV interference free at rated voltage and have low power factor. Standard equipment includes oil level gauges at side of reservoir and tap for p.f. measurement or voltage devices on side of mounting bracket.

Lapp Insulator Co, Inc, LeRoy, N. Y.



Automatic Oscillograph . . .

. . . starts operating within 2 millisec after fault or disturbance occurs. Designed specifically for power plant use, it provides permanent record of exact sequence of operation of protective system relays and breakers. After fault clears, RS-9 Thirty automatically quits operating and resets for next fault. Up to 150 faults can be recorded without attention. Spare recording lamps automatically replaced burned out lamp. Unit does not depend on a-c current for operation when fault occurs.

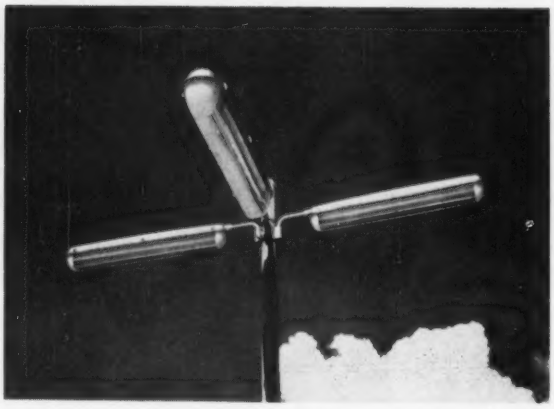
Hathaway Instrument Div, Hamilton Watch Co, 5800 E. Jewell Ave, Denver 22, Colo.

Highway Luminaire . . .

. . . with uni-directional reflector design can be mounted parallel to road in "Tee-Lighting" installation that increases light level without producing objectionable glare. With two such two-lamp, 18,750-lumen units parallel to road and a two, four, or six-lamp luminaire perpendicular to road, total lumen power from 55,250 to 93,300 can be obtained from single pole. Parallel unit mounts on either side of pole.

General Electric Co, Schenectady 5, N. Y.

(More New Equipment on page 88)



NOW...
double barreled performance

WITH THE ALL NEW AMP UTILI-TAP TEAM

The unique double barreled UTILI-TAP connector and matchmated tools offer a completely new and easy way to secure conductors at both ends of the service drop, at transformers and loop splices. No loose-piece hardware to fumble with, no periodic tightening or arm-wearying tooling. The UTILI-TAP team means maximum performance and long life, with greatest ease of application.

The UTILI-TAP Connector features:

- exclusive double barreled **locking crimp**—to guard against relaxation under varying load conditions
- **tin-plated** to resist corrosion and assure optimum electrical connection
- **pre-inhibited** with non-flow compound to remove oxide from aluminum conductors

The UTILI-TAP Tool features:

- crimping dies are permanently attached to tool head for quick die change
- open type head for easy access to conductor and quick release after application
- portability—lightweight (less than 8 lbs.)
- for wire size range 8 through 4/0 AWG—solid, stranded and ACSR—in all copper and aluminum wire combinations

For more information on the double barreled UTILI-TAP method, write:

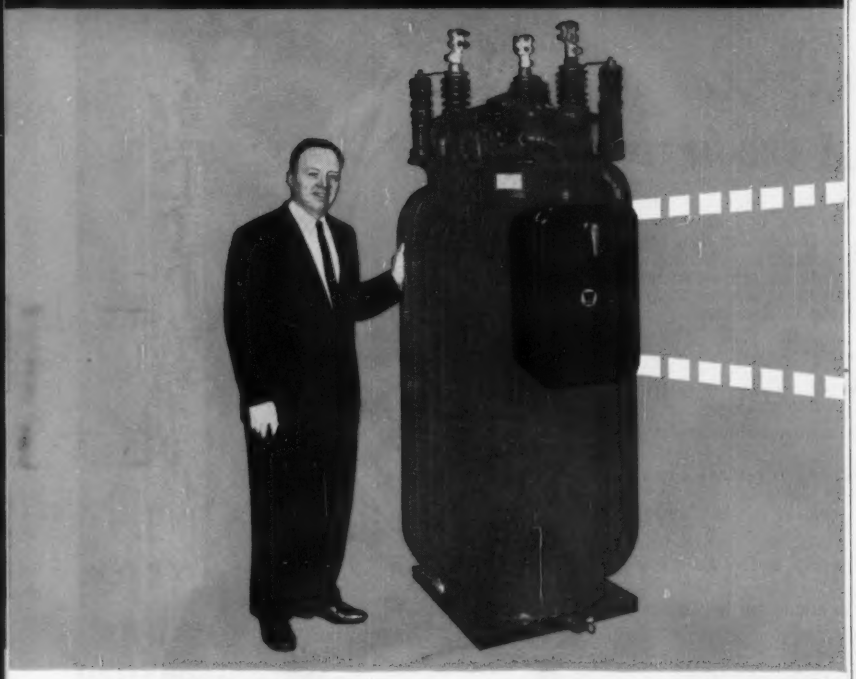
AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

A-MP products and engineering assistance are available through wholly-owned subsidiaries in: Canada • England • France • Holland • Japan

Ask your
Westinghouse representative
about the exclusive benefits
you get from

URL AND URF REGULATORS...: WITH THE RELAY THAT "READS" THE VOLTAGE



Inverse-time delay characteristics permit the CVR relay to match the correction to the need, correcting for large voltage errors quickly, for small errors with moderate speed. Because it "reads" the voltage, interpreting the rate of change, corrections are made faster than with fixed-time delay relays.

URL and URF regulators meet *all three* basic voltage conditions more effectively because:

- Gradual voltage changes . . .
  relay operation immediately outside band limit.
- Large rapid voltage changes . . .
  lower relay operating time . . .
  faster correction.
- Irregular, self-correcting voltage changes . . .
  no relay operation.

Result: better voltage control, narrower effective bandwidth.

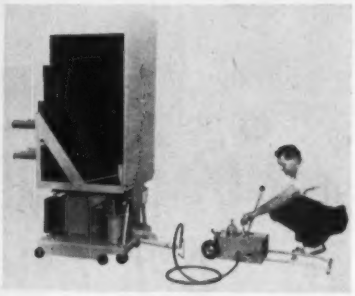
Call your Westinghouse representative for the full story of improved customer service through URL and URF regulators equipped with the inverse-time delay relay . . . made possible by PLOWBACK OF EARNINGS into research and development for better means of voltage regulation.

J-70869

YOU CAN BE SURE...IF IT'S Westinghouse

Emergency Closer . . .

. . . for air circuit breakers permits full speed closing with fewer hand strokes when normal power fails. Hand operated hydraulic unit is redesigned with bigger oil storage sump, separate from pump. Stronger return spring and use of quad rings instead of 0 rings increases speed of



piston return in actuating cylinder for horizontal drawout breakers. Larger air pocket space permits faster pressure release. Uni-directional oil flow and added relief valve allow self-purging of air.
Allis Chalmers Mfg Co, Milwaukee 1, Wis.

Stringing Block . . .

. . . for straight pulls permits quick, easy mounting on roofed or flat crossarms without special tools. Known as the Model XS-505, it accommodates cables through 1.75-inch diam. and fits crossarms through 5x6-in. size. Strong, light weight unit has aluminum alloy sheath with 7-in. diam and 3-in. width. Unit has anti-friction bearings.
Sherman & Reilly, Inc, 100 W First St, Chattanooga 2, Tenn.

Series Capacitor . . .

. . . comprising protective gap and capacitor is available for 2,400-, 4,800-, and 7,200- to 7,960-v distribution transformers rated 10 to 37.5 kva. Ratings include 2, 3, 5, and 7.5 kvar at 240, 480, and 720 v When abnormal voltage exists across capacitor, gap automatically bypasses capacitor once each half cycle. Gap reinserts capacitor when normal voltage is restored. Protective gap is hermetically sealed in corrosion resistant body.
General Electric Co, Schenectady 5, N. Y.

Outdoor Lighting Unit . . .

. . . accommodating one to three high to very high output fluorescent lamps comes in 6- and 8-ft lengths for 60-cps and higher frequency use. Unit is water-tight, dust-tight and treated for corrosion resistance. It may be surface or recess mounted.
Globe Lighting Products, Inc, 2121 S. Main St, Los Angeles 7, Cal.

Gasoline Generators . . .

. . . in 100, 125, and 150-kv ratings feature static exciter and magnetic amplifier regulator which regulates output voltage to within ± 3% from no load to full load. Wave form deviation does not exceed 5%. At full load and rated p.f., maximum instantaneous voltage dip is 20% of rated voltage. Stable operating conditions are established within two seconds after any sudden change in load. Designated models 100WA, 125WB, and 150WB, equipments comprise single-bearing, 4-pole, revolving field generator, coupled to water-cooled, gasoline engine.
D. W. Onan & Sons, Inc, Minneapolis, Minn.

Service Entrance Head . . .

. . . for cables sizes from three No. 2 to three No. 4/0 is easily installed. Cable end is completely covered by insulation, eliminating separate bushed openings and entrance of moisture into cable. Installation consists of merely forming drip loops

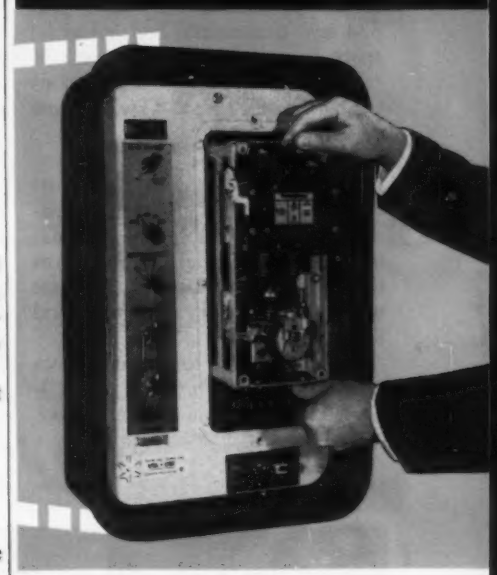
and inserting cable into cap. Slotted clamp secures cable. Cap is gray, molded fiber glass reinforced thermo-plastic material. The two models are designated as 252 and 256.
M & W Electric Mfg Co, Inc, East Palestine, Ohio

Mercury Floodlights . . .

. . . with high operating efficiency are offered in open, general purpose enclosed, and heavy duty models. Units to accommodate 100-, 400-, 700-, and 1,000-w lamps are included in line. The L-100 large open and enclosed units, the L-55 procelain enameled open units, and the L-80 medium sized enclosed floods have threaded stud that fits any American Standard 1.5-in. straight, tapered, or conduit thread and permits universal positioning. Meshing teeth on support arm assure firm positioning. Flat mounting bases are also available. Deluxe general purpose L-69A units use sturdy, cross-arm mounting brackets.
General Electric Co, Schenectady 5, N. Y.

CVR RELAY... AID TO BETTER REGULATION ...WITH

* less maintenance
* easier maintenance
* adjustable bandwidth



Because of built-in time delay, the CVR relay in Westinghouse URL and URF regulators operates its contacts only when a tap change is called for. Eliminating unnecessary operations reduces maintenance.

Maintenance is simplified by exclusive Flexitest* drawout construction which permits replacement of all relay control elements in only 10 seconds.

Lever-set voltage limits allow easy setting of the operating band, resulting in more accurate voltage levels. The time delay can also be adjusted easily and quickly.

* Trade-Mark J-70868

YOU CAN BE SURE...IF IT'S Westinghouse

Heat Push Outruns Estimates by 365%

WWP year-long campaign nets 1,395 new residential customers. Commercial and industrial space heating total is 534.

"Amazing" is how Washington Water Power Co officials describe the success of their first year of electric heat promotion.

In January, 1957, when the company began actively to promote new installations of electric home heat (EW, May 20, 1957, p 120) they had about 7,000 residential heat customers, or about 7% saturation. By December 31, they had 1,395 new residential heating customers, plus 534 new commercial and industrial space heating customers. The new residential primary installations totaled 16,400 installed kw; the new commercial, 6,626.

"The promotion's success exceeded everyone's estimate," reports Kimball Jack, vice president of general sales, promotion and information. "Our original estimate was that 500 new customers this year would have been a pretty good figure."

WWP was able to get such spectacular results through a well-planned promotional program of:

- Employee education
- Announcements to dealers, contractors and other industry officials
- Analysis of heated homes
- Budget billing plan
- Intensive advertising
- Employee tip program
- Equipment displays
- Electric heat talks

Results? In addition to those reported above, the promotion of electric home heating stimulated new interest in electric heat installations for commercial and public buildings. Largest commercial heat installations were a 122-kw job for a Grangeville, Idaho, mill and the 110-kw Diamond Bowl at Spokane.

The employee tip program produced 3,746 prospects for appliances, over 30% for some application of electric heat. Electric advertising sold 350 primary heat installations in six weeks. More than 3,000 key people were informed of electric heat's latest developments and growing acceptance in 62 group presentations.

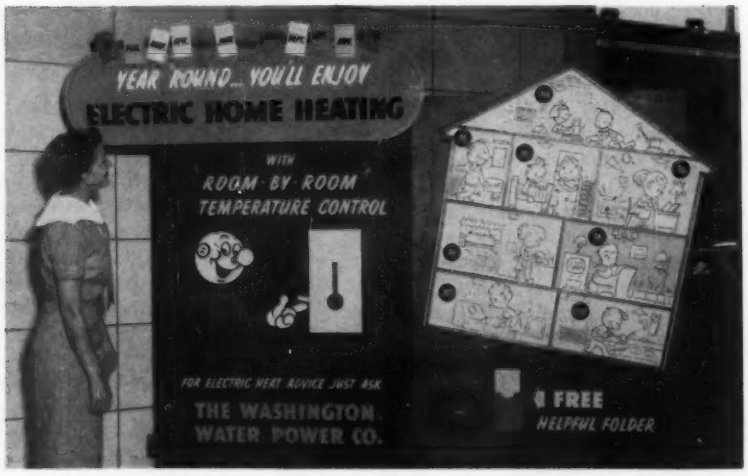
WWP figures showed annual cost for heating a typical 1,000-sq home was only $165, 16.5¢ per sq ft based on a two-yr load study of 50 area homes. A later study on heating a typical 600 sq ft apartment showed average annual heating cost of $41.60 a year, 8.6¢ per sq ft.

"Spectacular success of this 1957 promotion convinced us there is an acceptance of electric heating in our service area," Jack reports. "Consumer experience on a mass scale has dispelled the myth that it is prohibitively expensive. Properly engineered electric heat can be and is competitive with other forms of fuel. It's 'plus' benefits of convenience and flexibility are greater than those of any other type of heating.

A recent survey of prospective home buyers in the area showed that electricity is second in buyer preference only to oil. "An astounding gain when you consider that electric heat has been promoted actively in this area for only a year," Jack says.

Here's how new residential installations stack up:

By age of homes:	
New	29%
Less than 10 yr	19%
10-20 yr	19%
Over 20 yr	33%
By previous fuel:	
Oil	73%
Coal	14%
Gas, sawdust, wood, or other	13%
By types of electric heat:	
Wall heaters only	38%
Baseboard hts only	7%
Baseboard/wall combinations	45%
Other	10%
By equipment brand:	
Only one brand	64%
Mixed brands	36%



MAIN OFFICE DISPLAY at Washington Water Power Co pushes heating. Folder explains types of equipment, reassures on operating costs, offers budget billing

(*More Selling on page* 92)

When Enjay Butyl is used as continuous insulation of tubular aluminum conductors, traveling arcs are virtually eliminated, plug outlets are essentially dead-front.

ENJAY BUTYL

helps keep costs low in new Aluminum Busway!

Enjay Butyl is extruded over the full length of the conductors used in General Electric's new Type DE Busway, the first busway designed specifically for aluminum. This new busway incorporates all 22 features that engineers consider important in busway design, yet it is up to 30% smaller and 50% lighter than other busways of comparable rating.

Enjay Butyl rubber is ideal for use as continuous insulation of tubular conductors because of its inherent resistance to ozone and to heat aging. Add Butyl's excellent electrical properties, its vulcanizability and the fact that it is the *lowest cost* rubber on the market—and you'll understand why it was chosen above all other rubbers to do this job.

Every day manufacturers are discovering new ways to use economical Butyl. Find out how Enjay Butyl rubber can cut production costs for you. For further information and expert technical assistance, contact the Enjay Company.

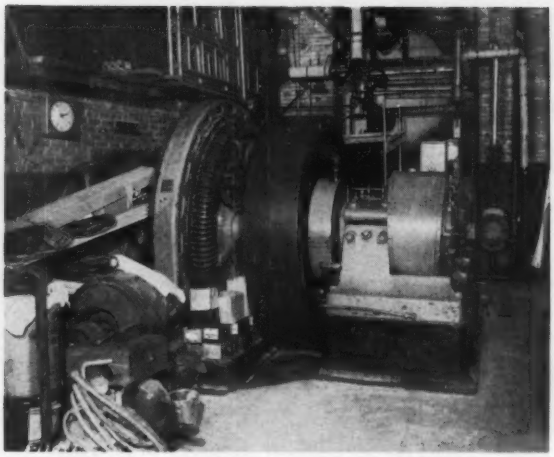
ENJAY
BUTYL

Enjay Butyl is the greatest rubber value in the world. It's the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

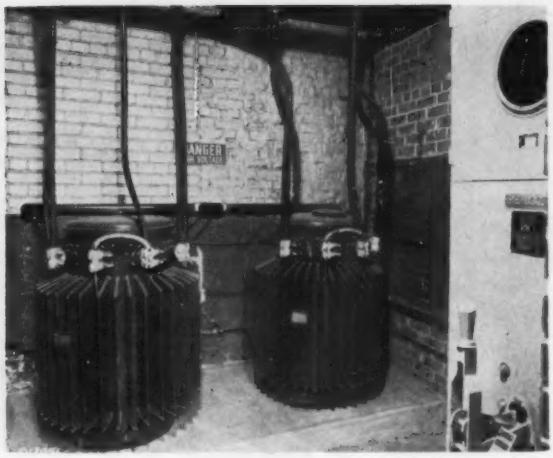
ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa



Replacing 35-year old generator . . .



with modern transformers and breaker . . .

Purchased Power Ends Overheating Motors

L. ALBERTSON, Supervisor, Sales Applications Dept, Philadelphia Electric Co, Philadelphia, Pa.

Overheated motors and low output lighting are things of the past at Kline's Coat, Apron, & Towel Service in Philadelphia, since the company switched from self generation to purchased power. Replacing a 150-kva and a 100-kva generator, the latter 35 years old, the new supply improved efficiency, economy, dependability, and convenience. The conversion relieved a shortage of power and enabled Klines to step up the pace of their modernization by installing 11 tons of air conditioning in the company offices.

Electric service is received at 2,400 v and stepped down to 120/240 v by two 167-kva transformers. Also included in the new equipment is a primary oil circuit breaker.

The switch was made when current demands outgrew the capacity of the generators and resulted in voltage fluctuations that overheated the motors and caused a sharp drop in lumen output of lighting. Maintenance was another difficulty. When one of the generator crankshafts needed replacement recently, it was estimated that the complete job would take about two months and that the casting alone would cost approximately $600.

150-Year Old Mill Reduces Maintenance, Boosts Production

FELTON PRICE, Power Sales Engineer, Mississippi Power & Light Co, Natchez, Miss.

Reduced maintenance cost, greater production, lower labor costs, more accurate lumber, and an adequate supply of power, are the big benefits realized at R. F. Learned & Son, Natchez-Under-The-Hill, Miss., since electricity was introduced at this oldest continuously operating saw mill in the United States. Electrification was necessary to relieve the load on steam boilers as well as for economic reasons. Total load is 148 hp.

Stacking of lumber, grinding of waste wood and running of a new "riderless carriage" have been electrified. A 15,000-lb. fork lift truck and an 25.5-hp electric stacker speed up handling of lumber. The hog which grinds up waste wood is now powered by a 50-hp electric motor, relieving the load on the boilers. Two 25-hp compressors which provide the compressed air to the riderless carriage are powered electrically.

The carriage, which holds the logs and moves them through the band saws, is controlled from a ten-button electrical panel. Previously, the operation required several men as riders to position the logs for sawing.

DEAD END WITH

BLACKBURN

W6-2A from 6 Sol to 2 ACSR
This Clamp Will Handle All Popular Service Drop Wires

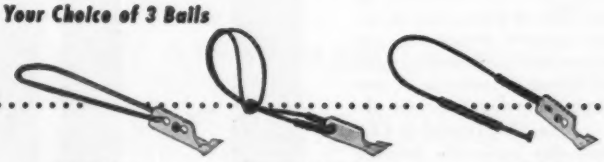
WEDGE CLAMPS

For Light Service
W6-4A
6 Sol to 4 ACSR

For Heavy Service
W2-OA
2 Sol to 1/0 ACSR

- Conductor in contact with wedge for entire length of slider.
- Removable aluminum slider allows installation without threading through clamp.
- Drop wire can be pre-sagged and cut to exact length needed.
- Can be attached to bare neutral at any point in the span.

Your Choice of 3 Bails



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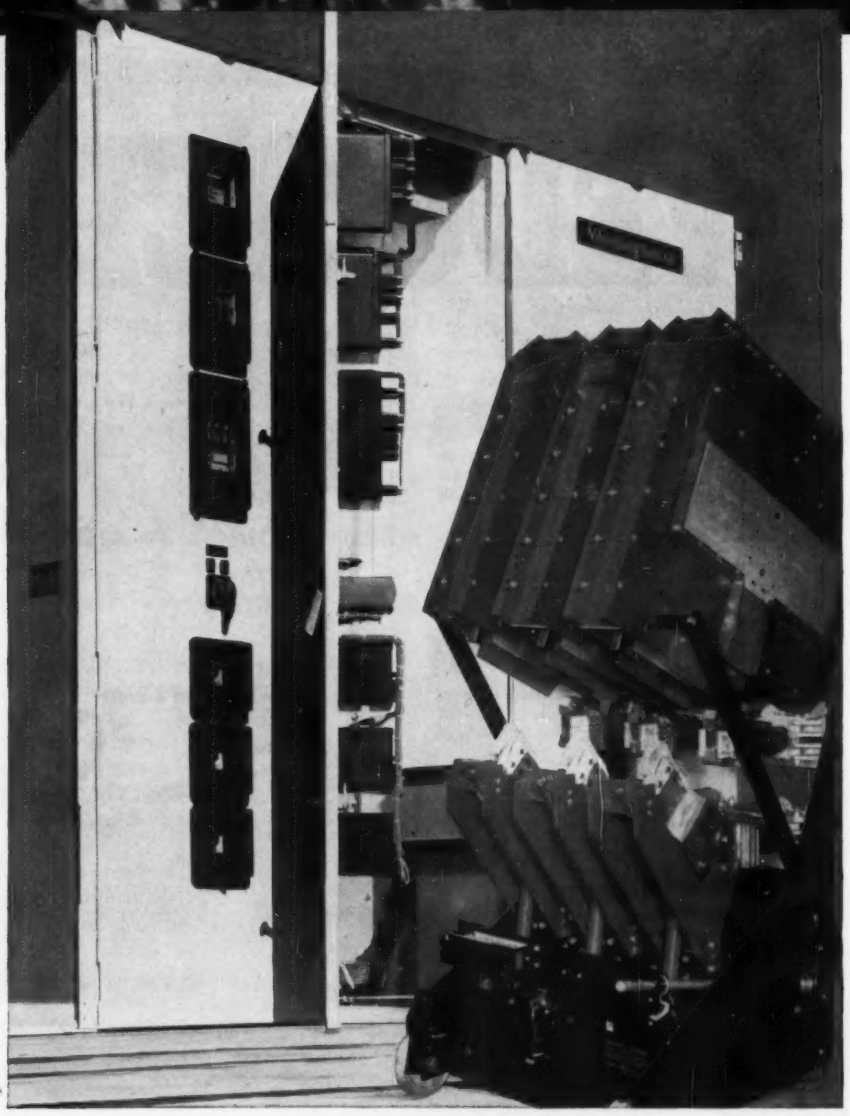


The 150-DH-1000 Breaker is easily removed from its cell for contact inspection or replacement. Breakers are drawn out horizontally, with no lifting or lowering. A few turns of a simple crank device on the front of the assembly move the breaker from the test to the operating position.

Plowback of Earnings into Research brings you Metal-Clad Switchgear with

15-KV AIR CIRCUIT BREAKER HAVING 1-MILLION-KVA INTERRUPTING CAPACITY

The 150-DH-1000 Breaker, with 1200 and 3000 continuous ampere rating, helps solve the problem of ever-increasing load concentration—particularly of utilities in large metropolitan areas.

In addition, this increased capacity is coupled with the exclusive Westinghouse De-ion® principle of arc extinction . . . fastest and most efficient method ever devised. The H-type iron circuit creates a strong and uniform magnetic field. The blowout coil in the center, in series with the arc, actually splits the arc in two, giving the effect of two interrupters in series in each arc chute.

Main contacts are self-aligning, multiple line, butt type. To provide easy accessibility for inspection and maintenance of contacts, the arc chutes are hinged at the rear, and a simple, easy-to-use tilting attachment is provided. Contacts are at convenient working height.

These features mean you'll be better able to handle larger loads *safely* in metropolitan generating substations and to realize greater economy in utility and industrial substations of high capacity.

For full information about 150-DH-1000 Breakers or SHELTERFOR-M, call your Westinghouse Representative, or write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa.

OUTDOOR MAINTENANCE COMES INSIDE WITH . . .

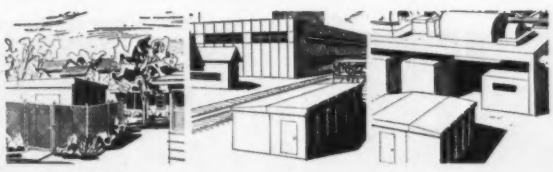
Shelterfor-M* Metal-Clad Switchgear

Westinghouse SHELTERFOR-M is designed to protect both equipment and personnel from the weather. Inside working areas are roomy, all equipment is easily accessible for servicing. Clean, modern lines make SHELTERFOR-M adaptable to suburban community surroundings. SHELTERFOR-M offers easy flexibility for growing loads and system expansion without costly construction and alterations.

J-60942

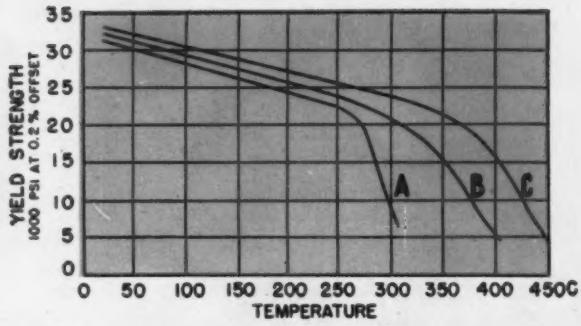
YOU CAN BE SURE... IF IT'S

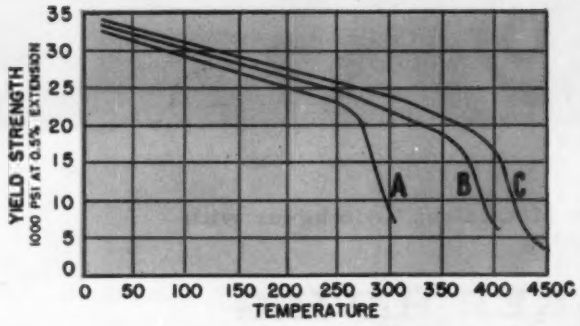
Westinghouse

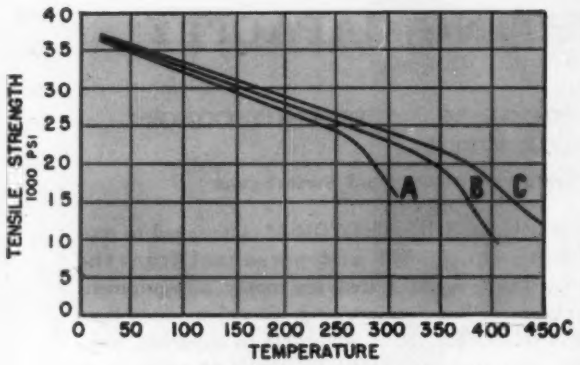


*Shelterfor-M: Shelter-for-Maintenance

How to give electrical conductors an improved margin of safety at elevated temperatures







A. Silver content normal
B. Silver 8.7 ounces per ton
C. Silver 28. ounces per ton

Copper strips cold rolled,	0.050 ins. gage
Time to heat, approximately	1¼ hours
Time of test at heat, approximately	¼ hour
Speed, testing machine head,	0.01 ins. per min.

American Brass Company Metallurgical Research Laboratory

Tests show influence of silver on tensile properties of high-conductivity copper at elevated temperatures

Silver-bearing copper is used extensively in windings, collector rings, and commutators of motors and generators, in order to retain structural strength at elevated temperatures during assembly and operation.

There are now many other places where electrical conductors must stand up under temperatures well above those heretofore considered normal.

The amount of silver needed to meet a particular set of conditions, however, has until recently been difficult to determine. At the left are charts summarizing the results of tests made in The American Brass Company Metallurgical Research Laboratory, which can help serve as a more precise guide.

The curves for the yield strengths at 0.2 per cent offset and 0.5 per cent extension are significant to electrical engineers with problems involving the operation of conductors at elevated temperatures, for these values are indices of the limits of elastic behavior. The drop in absolute values of the tensile properties of all three coppers with rising temperature, however, should be noted and be allowed for in the selection of shape and size of conductors that are expected to run hot.

For more complete information on the effect of temperature on the mechanical and electrical properties of copper, send for a copy of Publication C-25, "Anaconda Copper for Electrical Conductors." This 62-page book also has a wealth of other general information, plus convenient new tables to help you in the selection of rigid bus conductors.

Technical Service. The assistance of Anaconda specialists in the selection of conductors to meet your special problems is available to you. For such assistance—or to get a copy of "Anaconda Copper for Electrical Conductors"—see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 87101

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COPPER CONDUCTORS
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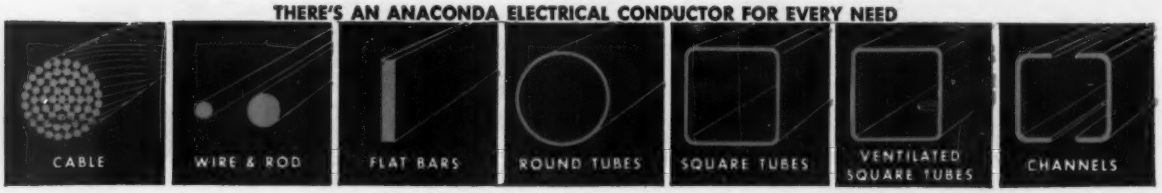
THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



Report on
Rate of Return

Average rate is up slightly in all jurisdictions, but . . .

'Fair Value' Yields Top Returns

Rates of return are rising, but the average is still below 6%. That's the conclusion reached from an extensive study just completed on the rates of return of U. S. power companies. A total of 103 Class A and B private electric utilities were analyzed. Their financial statements for the years 1953 and 1957 were checked to determine rates of return for the two years. Average rate of return in 1957 was 5.71%—up from 5.57% in 1953.

Here are some of the other conclusions that can be drawn from the study:

- **Power companies in "fair value" jurisdictions drew higher rates of return** than did companies in jurisdictions where "original cost" is the rule. In 1957, "fair value" companies averaged 6.25% and "original cost" companies, 5.43%. The averages in 1953 stood: "Fair value"—5.99%; "original cost"—5.35%.

- **Smaller power companies generally fared better than large ones,** and two "middle-sized" companies led the list.

- **The ten large metropolitan companies showed higher rates of return** than the average of the ten largest companies.

- **Over half the companies analyzed had rates of return of 5.25% to 6.24%.** Distribution of rates of return was not abnormal.

- **About 60% of all companies analyzed increased rate of return since 1953,** while about 40% showed a lower rate of return in 1957 than in 1953.

The 103 companies studied make up a broad cross section of the investor-owned electric utility industry in the United States. They include utilities from all parts

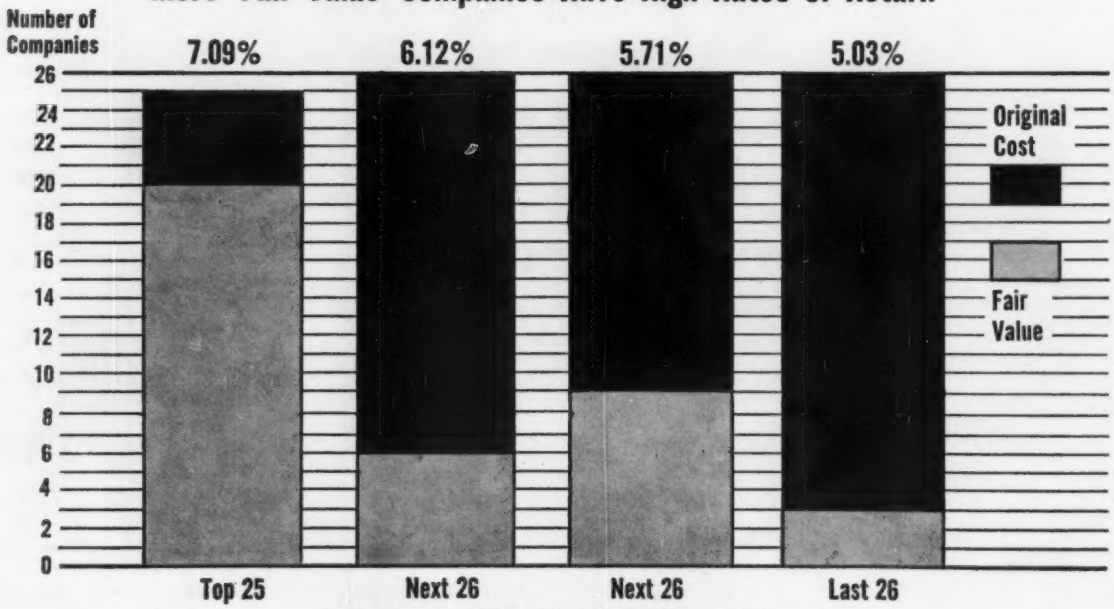
of the country; ranging in size from the smallest to the largest; operating in service areas that are urban, suburban, rural, and combined; and regulated under many jurisdictions. Their capitalization represents approximately 85% of the total capitalization of Class A and B electric companies.

In this study, the rate of return was taken as the ratio of gross income (numerator) to total capitalization (denominator). Specifically, the numerator is gross income after all operating expenses but before payment of bond interest and dividends on preferred and common stock. The capitalization taken as denominator includes all bonds, capital stock, surplus, and notes payable to banks.

Rates of return for "fair value" companies came out substantially higher than those for companies in jurisdictions that use the "original cost" concept in setting rates, according to this method of analysis. "Fair value" means commissions give some weighting to present value of plant, while "original cost" means what the name implies or investment made many years ago. A majority of states permit "fair value" under statute; however, in practice many give nothing but original cost. Study breakdown was based on practical rate making rather than statute.

Companies actually under "fair value" led both in 1953 and in 1957. Not only that, but between '53 and '57 the "fair value" companies increased their lead over the "original cost" companies.

More 'Fair Value' Companies Have High Rates of Return



(Breakdown by Quartiles of 103 Power Companies)

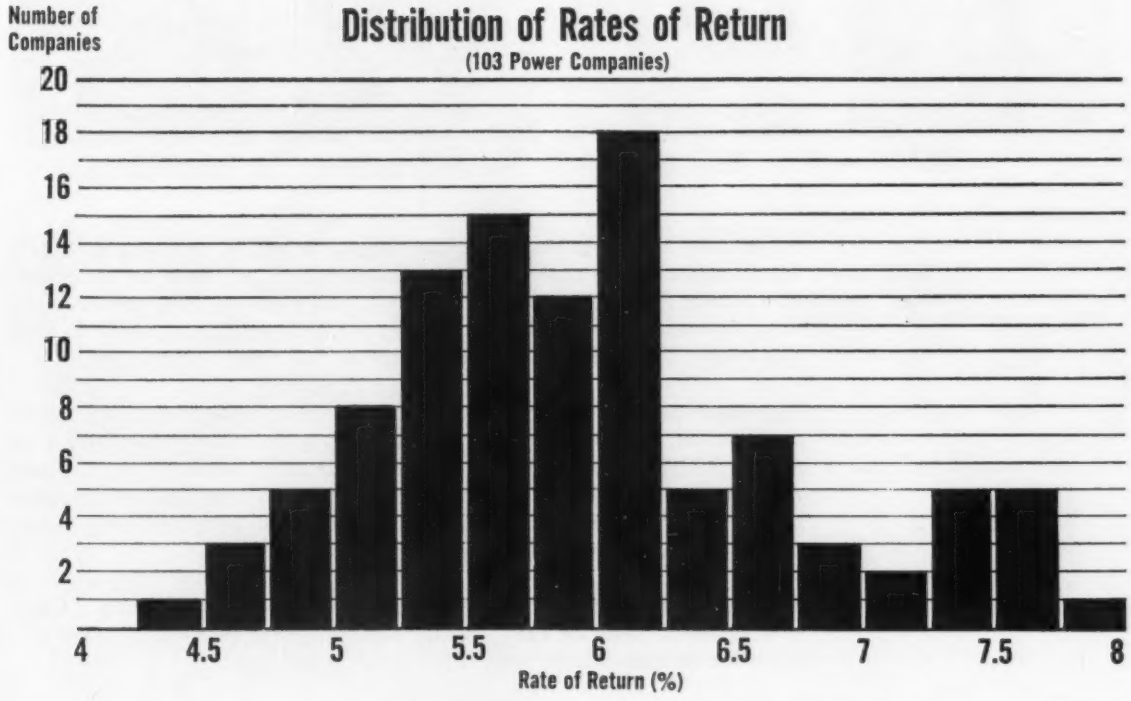
Here's an example that's even more striking. The 103 companies were ranked in order of 1957 rate of return, and split into four parts—top 25 companies comprising one group, with three groups of 26 companies following in descending order. Of the top 25 companies, no less than 20 were in "fair value" jurisdictions; and two were special situations where (although the commissions adhered to "original cost") year-end rate bases were granted, full cash working capital

allowed, and rapid tax amortization allowed for rate-making purposes. In the bottom 26, on the other hand, there were only three "fair value" companies and 23 in "original cost" jurisdictions.

The top 25 companies posted a 7.09% average rate of return in 1957. Of the 13 companies returning over 7%, ten were "fair value," two were modified "original cost," and only one was under a strict "original cost" jurisdiction.

The average rate of return for the bottom 26 companies was 5.03%. Nine companies returned less than 5%. All of them were in "original cost" jurisdictions. In fact, "original cost" companies occupied the lowest 17 slots in the ranking.

The spread from highest to lowest rate of return was more than 3.7%—between two companies of comparable size, operating side-by-side in service areas with a common boundary. Although all other considerations are not equal, it is true that the high company is in a "fair value" jurisdiction, while the low company has its rates set on an "original cost" basis.

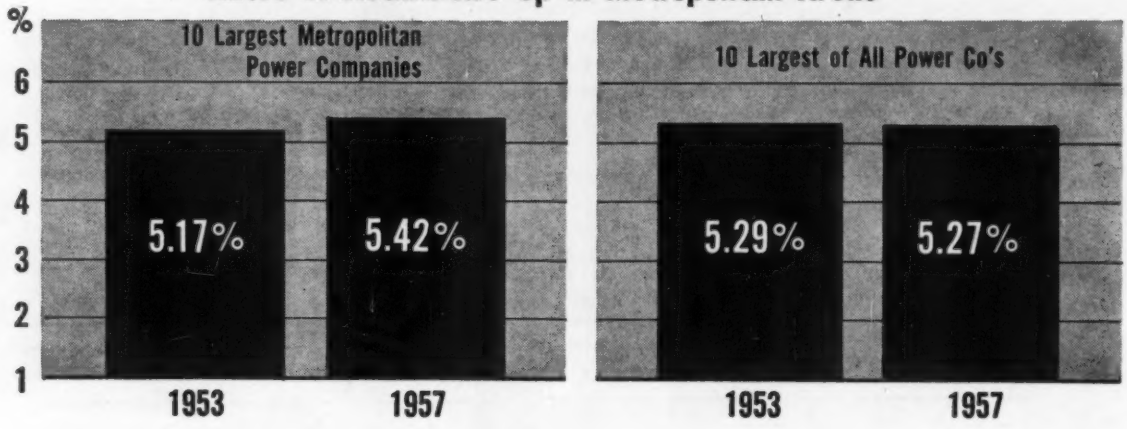


Between the extremes, distribution of rates of return is not abnormal. Over half of the companies (58) had rates of return that fell within a 1% interval between 5.25% and 6.24%. Of these 58 companies, 18, or 31% of the total, were in "fair value" jurisdictions. Of the 28 companies in the interval from 6.25% to 8%, there were 20 (or 71%) in "fair value" jurisdictions; while of the eight "original cost" companies, three belonged to the special group where more liberal rate base allowances were granted by the commissions. Of the 17 companies in the 4.25% to 5.24% group, none were in "fair value" jurisdictions.

As a group, the smallest companies turned in the highest rates of return. The

1957 average for the 26 companies having the smallest capitalization was 6.31% —up from 6.12% in 1953. The largest companies showed the lowest rates of return, on the average, as well as the slowest growth rate since 1953. In 1957 the 25 companies with the largest capitalization earned an average rate of return of 5.49%. Four years earlier their rate had been 5.41%. The middle-sized companies in the second and third quartiles (which included most of the "fair value" companies) averaged around 6% rate of return for 1957. However the two companies with the very highest rates of return were from the middle group.

Rates of Return Are Up in Metropolitan Areas



To see how the larger companies have lagged in rate of return, consider the figures on the ten with the largest capitalization of all. Of these ten companies, representing 38% of the total capitalization, return was not only well below the average; but it had declined fractionally from 5.29% in 1953 to 5.27% in 1957 (see chart). Three of these companies were in "fair value" jurisdictions.

In comparison, the metropolitan utilities showed up rather well. Ten largest metropolitan companies showed a surprisingly substantial increase—from an average 5.17% rate of return in 1953 to 5.42% in 1957. Although this composite return was still considerably below the average for all companies, it surpassed the average return of the ten largest of all companies. Four of the big metropolitan companies are in "fair value" jurisdictions.

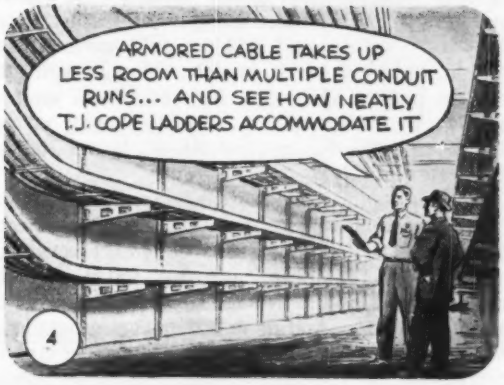
A group of ten so-called "growth" companies justified the title with a 6.8% average rate of return for 1957. In 1953 the average had been 6.38%. Only one of the ten companies came under strict "original cost" jurisdiction.

Companies that were good earners in 1953 tended to increase their gains in 1957, while many poor earners showed further declines. Of the 25 companies with the highest 1957 rates of return, 16 showed increases over 1953. Fourteen of the lowest 26 showed declines.

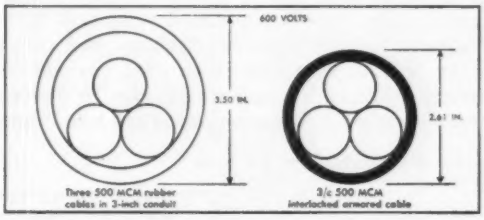
In all, 41 companies showed reductions and 62 showed gains from 1953 to '57. "Fair value" again fared better than "original cost" in that of the reductions only 34% of the companies were in "fair value" jurisdictions, while of the companies that showed increases 38% were "fair value." "Fair value" companies made up 37% of the entire sample. In other words, there were fewer "fair value" companies that had reductions, and more "fair value" companies that had increases in rate of return over the five-year period.

ROMAN ARMOR'S BEST...

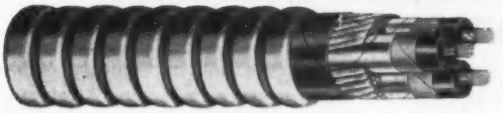
LOTS OF AIR AROUND THE ARMOR... HEAT IS'NT BOTTLED UP HERE LIKE IT IS INSIDE CONDUIT. THAT'S WHY THESE CABLES CARRY MORE CURRENT
3



A matter of FACT



Reduced space requirements Less space is needed for Rome Cable's interlocked armored cable --almost one inch less width for each three-conductor 500 MCM interlocked cable than for cable-in-conduit type installations.



For 600- to 15,000-volt service Rome's interlocked armored cable is available in three-conductor construction with Rozone A (butyl) insulation. It offers many more benefits than described here. For complete information, contact your nearest Rome Cable representative and ask for your free copy of Bulletin RCP-730. Or mail the coupon today.

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G. L. FURR, Appalachian Electric Power (left), newly elected president of Southeastern Electric Exchange, discusses SEE's 25th anniversary with L. V. Sutton, Carolina Power & Light, and Dr. C. G. Suits, General Electric Co, a speaker

At SEE Meeting . . .

Urges Dependable Atomic Power

Sporn says utilities should aim at lower costs; Boca Raton meeting elects G.L. Furr president

Utility company research and development must aim at dependable atomic power and lower costs, generally, Philip Sporn, American Gas & Electric Co, told the Southeastern Electric Exchange recently at Boca Raton, Fla. At the same quarter-century anniversary meeting, SEE elected G. L. Furr, vice president and general manager of Appalachian Electric Power Co, as its new president.

In pursuing these aims, the utility industry should follow the lines of advancement made with conventional steam plants, Sporn continued. It should seek to develop larger units, higher pressures and temperatures, higher reheat, and possibly multiple reheat. He urged a concentration of effort on the development of a low enrichment fuel, simpler fuel elements, and simplified cooling systems, especially those using gas and steam. Research projects, he said, should also be directed to breeder reactors, both homogeneous and heterogeneous.

Higher Distribution to Be Rule

Sporn predicted that by 1975 about 5% of the industry's total capacity—roughly 20 million kw—may be nuclear, and this capacity will produce about 7½% of the energy. In the five years following 1975, about 25% of the capacity added will be nuclear, he said, pointing out that this would be at an average rate of 6 million kw per year.

Higher secondary distribution voltages will be the rule for both residential and commercial customers by 1978, said Tomlinson Fort, Westinghouse Electric Corp. By then residential distribution will be underground, and dc transmission over high-voltage underground cable will be beginning to appear in metropolitan areas, Fort declared. Generator unit size will reach 750 to 1,000 Mw and the physical volume per kva of generators and transformers will have considerably declined, he said. He attributed the latter development to improved iron, insulation, and cooling methods. A 1958 800-Mva transformers, will be no larger than today's 400-Mva model.

The industry must disabuse investors who have been told that utility common stock is sluggish and largely defensive, said F. W. Page, Tri-Continental Corp.

"Even the slowest moving utilities," he said, "have kept pace with the industrials during the past seven years."

Earnings of non-city utilities, he said, were 2½ times those of industrial stocks, and the gains of city utilities compared with those of industrials.

J. W. McAfee, Union Electric Co of Missouri, urged that all companies continue sponsoring the Electric Companies Advertising Program.

Utility thinking must center around coal between now and 1975, said Electrical World's Fischer Black. The use of coal, he said, will not only increase about fourfold, but its share of annual production will grow from the present 55% to at least 66.5% of the total in 1975. By then, coal prices will have gone up perhaps 30 to 40%, but gas and oil will be up 200 and 140%, respectively.

"Nothing on the technological horizon gives promise of replacing rotating machinery for generating electricity," said Dr. C. Guy Suits, General Electric Co. Gains in generation are available today, he said, through increasing the average size of units above the present 120 Mw. And more economical generation is possible through the use of single and double resuperheating, larger last-stage buckets, and high-speed, steam-turbine drives for boiler feed pumps.

Says Throttles Could Go

Engineers, he noted, are now trying to coordinate the operation of high-pressure boilers and turbines to use variable initial pressures for load changes. This development, he said, could simplify designs that could combine full-load efficiency with economic light-load operation.

When high-pressure natural gas is available, it might be possible, he said, to eliminate throttles, to heat gas by means of steam or flue gases, and to put the heated gas through a pressure-reaching turbine generator. Such a system, he concluded, could add 2 to 3% to the station capacity through the utilization of wasted heat.

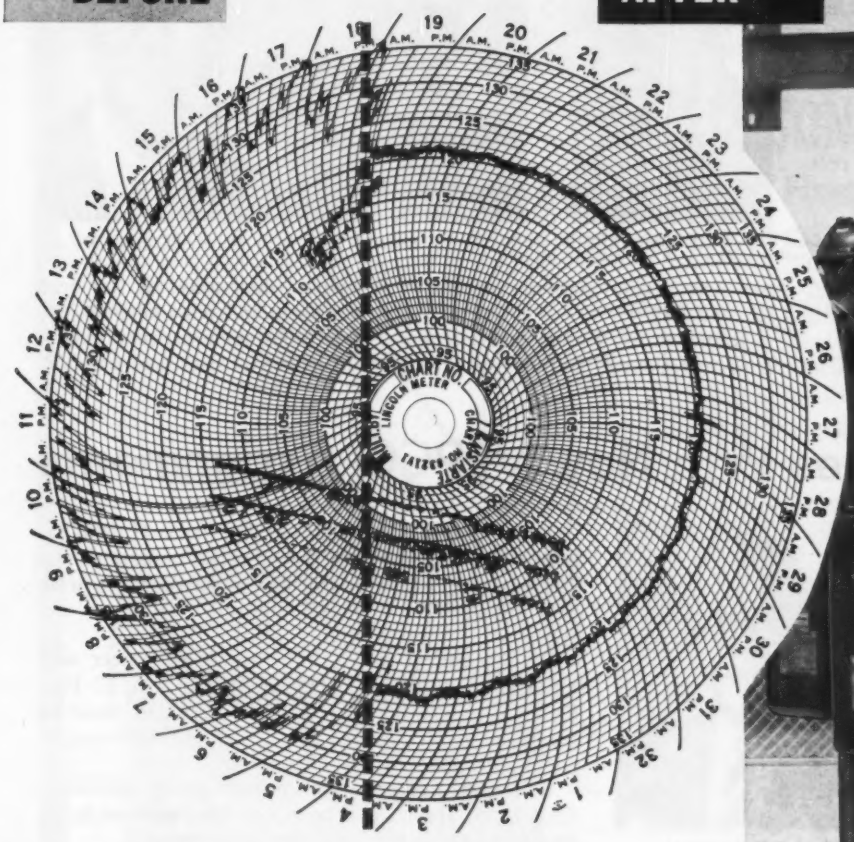
ALLIS-CHALMERS — 25 years of 5/8% step regulator leadership

Solution To:

High Voltage Problem

BEFORE

AFTER



Eliminate fluctuating voltages, burnouts, high voltage complaints by using Allis-Chalmers 5/8% step regulators

This actual chart illustrates how Allis-Chalmers regulators corrected these problems.

Whether your problem is high voltage or low voltage, take advantage of close control with the narrow 1 or 2-volt band width you can maintain using Allis-Chalmers step regulators.

For more information, call your nearby A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Originators of 5/8% Regulators

ALLIS-CHALMERS

A-5711

Houston L&P Elevates Three to Top Positions

In a series of executive promotions, Houston Lighting & Power Co elevated W. A. Parish to board chairman and chief executive officer, T. H. Wharton to president, and P. H. Robinson to executive vice president.

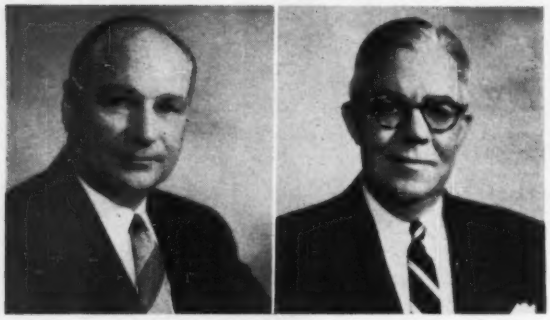
Parish has been president since 1953. Before joining HL&P in 1927 as a vice president, he had served as legal counsel for the utility. At present he is president of Texas Atomic Energy Research Foundation.

Wharton, executive VP since 1953, comes to his new post with a background in accounting and finance. Since 1922, when he joined HL&P as an accountant, he has been assistant secretary-assistant treasurer, general auditor, comptroller, and VP.

W. A. PARISH T. H. WHARTON P. H. ROBINSON

Robinson is former vice president-operations. During his 30 years with the utility, he has been transmission and relay engineer, industrial sales engineer, superintendent of industrial sales, assistant VP.

Key Executives Win New VEPCO Assignments



E. H. WILL A. H. McDOWELL

At Virginia Electric & Power Co, Erwin H. Will has been elected chairman of the executive committee and vice chairman of the board. He is succeeded as president by A. H. McDowell, Jr. G. D. Gibson was appointed general counsel.

Will, president since 1956, began his career with VEPCO in 1922. In 1935 he left to join El Paso Electric Co, where he later became president. Since his return to VEPCO in 1947 he has been general manager-operations, and VP-general manager.

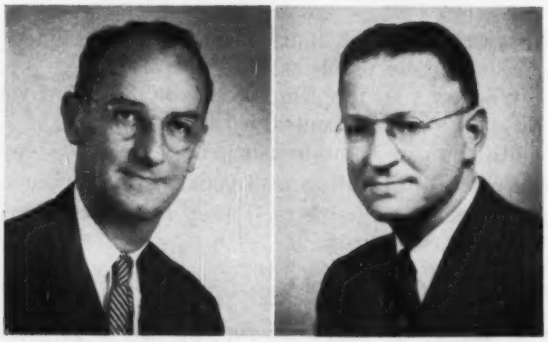
McDowell has been system manager of operations since 1956. He has also been executive assistant to the president and district and division manager.

Metropolitan Edison Advances Parry and Neidig

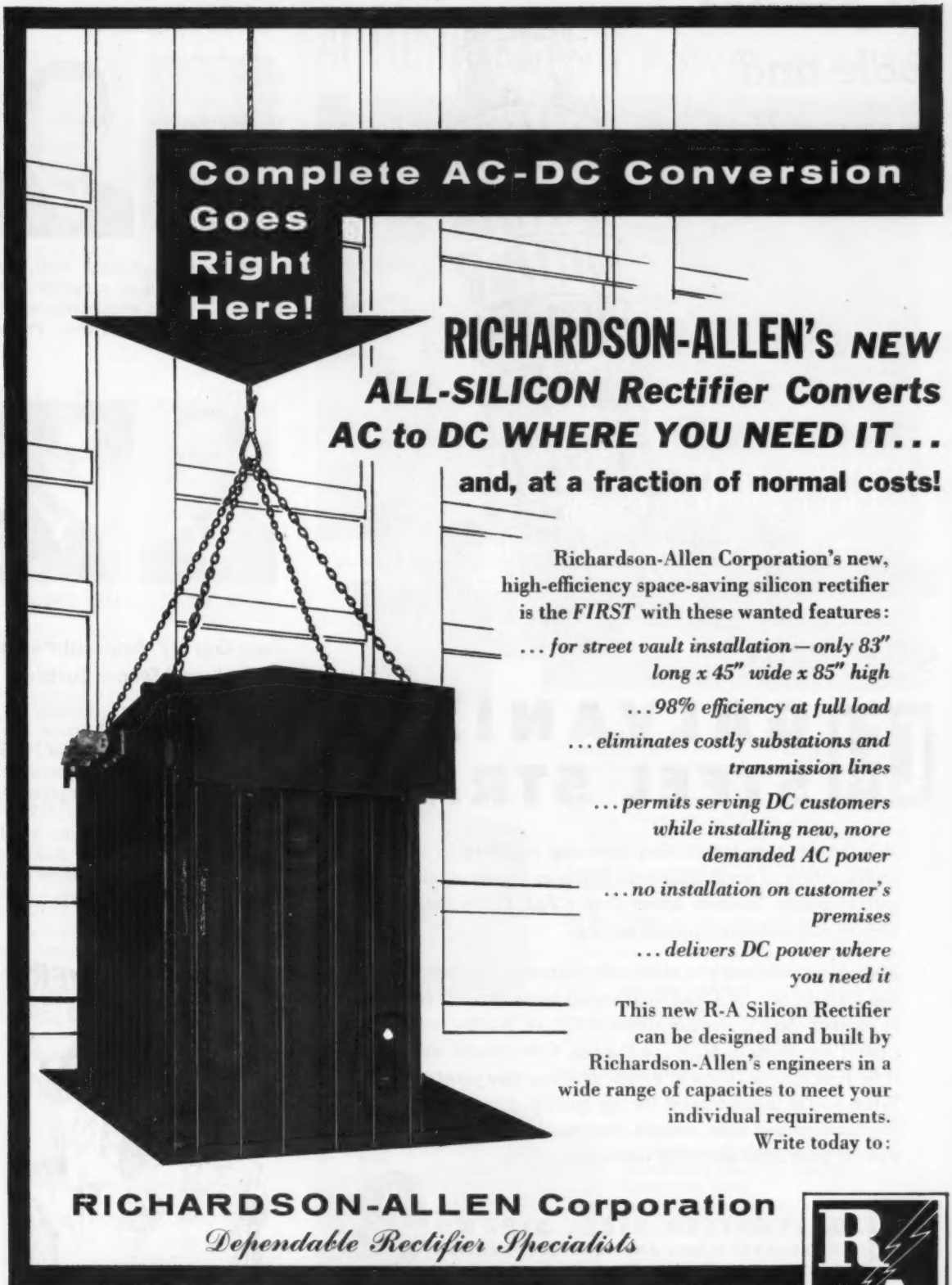
G. Raymond Parry has been elected as executive vice president and Ralph E. Neidig as vice president and chief engineer of Metropolitan Edison Co.

In his new position Parry will be responsible for MECO's activities in 14 eastern Pennsylvania counties. An engineering graduate from Lafayette College, he has held numerous engineering and managerial posts during his 32 years with the utility. He has served as vice-president of operations since 1956.

Neidig, chief engineer for the past five years, will continue in charge of MECO's engineering work. The new vice president, who joined MECO 33 years ago as relay tester, is a Fellow in the American Institute of Electrical Engineers.



G. R. PARRY R. E. NEIDIG



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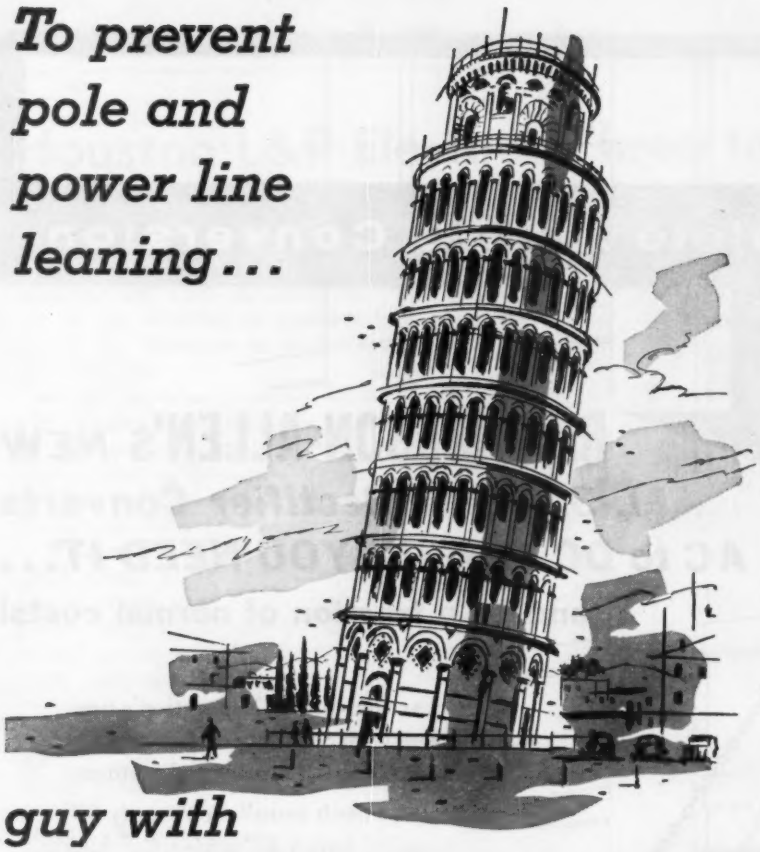
IN CANADA: Richardson-Allen of Canada, Ltd., 1236 Birchmount Rd., Scarborough, Ontario

To prevent pole and power line leaning...



guy with

CF&I GALVANIZED STEEL STRAND

Whether it is an installation involving exposure to the corrosive action of acrid industrial fumes or to severe storms—public utility linemen know that CF&I Galvanized Steel Strand will withstand rugged service.

Meticulous adherence to standards characterizes every step in the manufacture of CF&I Galvanized Steel Strand. It meets or exceeds ASTM Specifications A-122 or A-363—or, if you prefer, our Buffalo, N. Y. or Pueblo, Colo. plants will make it to your specifications in seven- or three-wire constructions. When you're in the market for top quality, guy, messenger or overhead ground wire, contact your nearby CF&I representative or your local electrical distributor.

5690

GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver Detroit • El Paso • Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City San Francisco • Seattle • Spokane • Wichita. CF&I OFFICES IN CANADA: Montreal • Toronto

A&FP Ups Amoss

W. J. Amoss has been elected a vice president of American & Foreign Power Co, Inc. He is also president of Cia Cubana de Electricidad, a subsidiary.

Amoss, who started with Cia Cubana in 1956 as executive VP, gained 21 years engineering experience with New Orleans Public Service, Inc.

H. G. BAUER HARRY ENGVALL

Two Get VP Appointments At De Laval Steam Turbine

Two appointments recently announced by De Laval Steam Turbine Co were the elections of H. G. Bauer as executive vice president and Harry Engvall as vice president in charge of engineering.

Bauer, most recently vice president and general sales manager, continues the duties of general sales manager in his new position.

LIVE BETTER... *Electrically*

Herman Is Elevated

New president of Sperry Rand Corp's Remington Rand Division is Kenneth R. Herman. He will continue as a member and vice-chairman of the firm's board.

Herman, who succeeds retiring James H. Rand, was formerly president of Vickers, Inc, a subsidiary.

Gude Becomes VP

Harry E. Gude has advanced to VP-manufacturing of Olin Mathieson Chemical Corp's Aluminum Div. He was manager of the unit's rolling mill being built in Ohio. Gude will now head operations in Chattanooga, Gulfport (Miss.), and Riverside (Calif.)

Bixler Advances

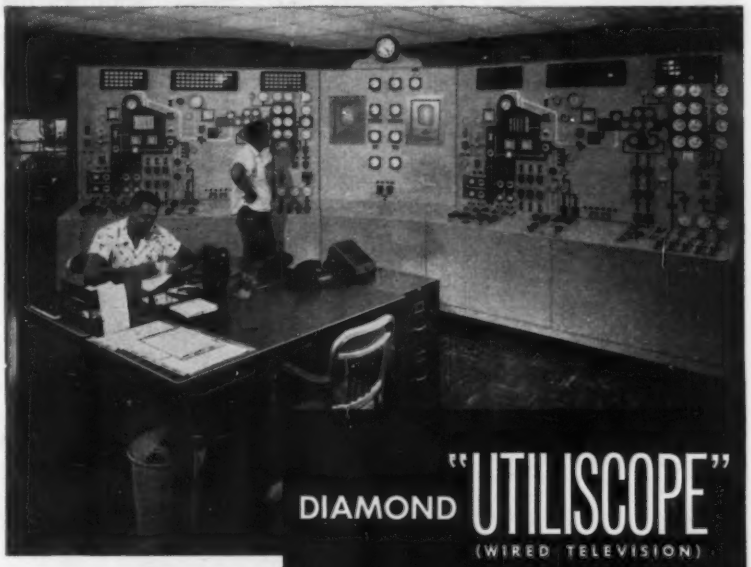
Day - Brite Lighting, Inc, has elected Stanley M. Bixler senior VP-general manager. He will remain VP of Day-Brite Lighting, Inc, of California.

Bixler will now direct operations of the sales, finance, and productions divisions of the company.

Air Preheater Ups Four

At Air Preheater Corp, H. S. Marshall has been appointed as executive vice president and W. E. Hammond and T. R. Halstead as vice presidents. In addition, Hilmer Karlsson was named assistant to the president and consulting engineer.

AUTOMATION IN POWER PLANTS



DIAMOND "UTILISCOPE"
(WIRED TELEVISION)
HEAVY DUTY EQUIPMENT FOR VISUAL INFORMATION

"UTILISCOPE" CAMERA

"UTILISCOPE" RECEIVER

The Diamond "Utiliscope" makes possible the ultimate in automation for power plant control. It enables the operator to see clearly anything that requires visual check. He no longer need depend upon indirect interpretations to know what is happening outside his range of vision.

The operator in the above photograph is watching the ITV image of the water level in two boilers . . . transmitted by "Utiliscope" cameras focused on Diamond Bi-Color water gauges. The water levels are easily and unmistakably read on the viewing screens. There can be no error . . . the level is shown correctly or there is no picture.

The Diamond "Utiliscope" is heavy duty equipment for power plant application. Other power plant uses are: watching flame conditions in boiler furnances, watching smoke emission from stacks, and watching remote entrances for intruders. Have you explored the "Utiliscope's" resources for saving money and improving operation? Use the coupon below for further information.

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

7800

DIAMOND POWER SPECIALTY CORP.
ELECTRONICS DEPT., P.O. BOX 58R
LANCASTER, OHIO

Please send me without obligation a copy of bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs and improve operations.

Name_____

Title_____

Company_____

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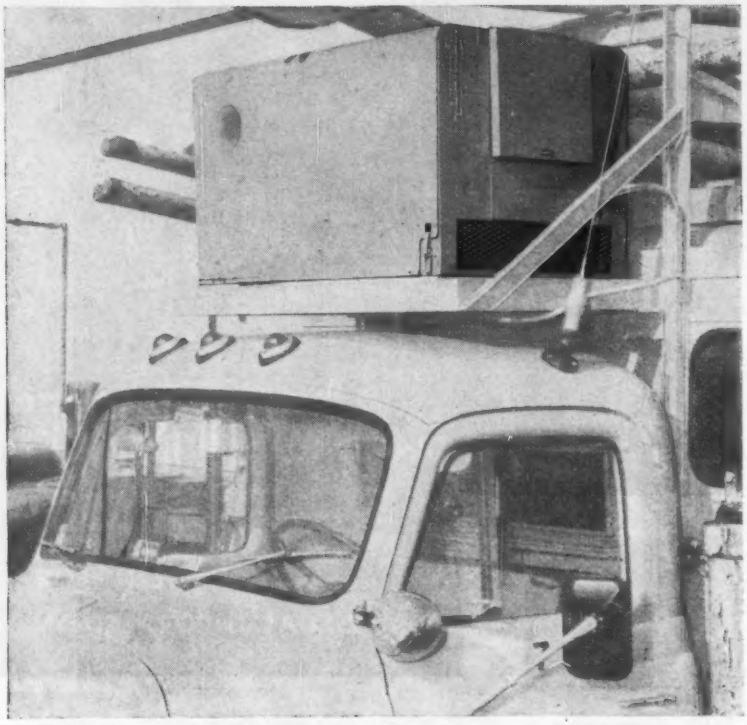
Onan ELECTRIC PLANTS

ELECTRIC PLANT NEWS

Onan ELECTRIC PLANTS



For keeping radio batteries charged . . .

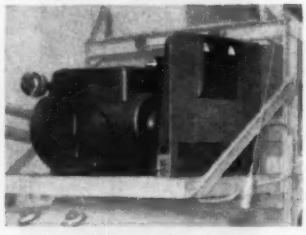
Truck-mounted Onan Electric Plant saves 6-10 gallons of gas per day!

Operates Onan Rectifier Battery Charger installed in truck body; delivers 2,000 watts A.C. for tools and lights.

This 2KW Onan Plant, driven by a single-cylinder, air-cooled engine of 5 H.P. makes it unnecessary to run the 150 H.P. truck engine for battery charging. It saves gasoline and cuts down on truck engine maintenance. Savings of from $2.00 per day to $800.00 per year per truck have been reported. Moreover, the electric plant supplies 2 KW of *plug-in power* for electric saws, drills and lights used in construction and maintenance.

The installation above has the plant mounted over the truck cab. Other companies have installed units within the truck body. Onan air-cooled plants equipped with the optional, low-cost Vacu-Flo system *can be completely enclosed.*

There's an Onan Packaged Power system that can cut your costs substantially. Describe your need and let us help you.



ONAN MODEL 2LK-IRV shown with weatherproof steel housing removed. Mounting frame is attached to truck body. Plant is accessible for servicing. Entire unit can be transferred easily to new trucks. This plant is started electrically.

Special folder F-111 describes 3 Onan battery charging systems. Write or call.

D. W. ONAN & SONS INC.

2828A University Ave. S.E., Minneapolis 14, Minnesota

ELECTRIC PLANTS • AIR-COOLED ENGINES • KAB KOOLER • GENERATORS

Onan ELECTRIC PLANTS

Lockwood is Named VP Of Pole Treating Firm

Asplundh Tree Expert Co has announced the appointment of L. E. Lockwood as vice president of its new subsidiary, the Pole Treating Co. Lockwood, who recently retired from Commonwealth Edison Co, will work in the Midwest, with headquarters at Wheeling, Ill.

The new subsidiary will offer a service to utilities by extending life of standing poles by groundline and above ground treatment.

PERSONAL BRIEFS

William G. Meese is new director of Detroit Edison Co's engineering laboratory and research dept . . . Alabama Power Co recently named **Alan R. Barton, Jr,** assistant to Executive Vice President **H. Neely Henry. Wylie P. Johnson** succeeds Barton as superintendent of transmission, general office. In the Southeast Division, **William C. Long** became chief engineer.

Duquesne Light Co has advanced **William P. Cook** to superintendent of operations, eastern district, and **Maine Peace** to office manager, transmission and distribution dept.

William R. Poole, Toledo Edison Co's general sales manager, has been elected to the company's board. Elected as assistant secretary was **Donald G. Nicholson** . . . Niagara Mohawk Power Corp has designated **Coburn D. Hollister** as system general sales manager with headquarters in Syracuse . . . At Union Electric Co, **Edwin C. Ryan** has been made commercial sales engineer.

Andrew J. Bowen has been named director of district operations for the Potomac Edison System companies. **Philip N. Hunter** was appointed Winchester district manager.

New secretary of Iowa-Illinois Gas & Electric Co is **Donald H. Shaw** . . . Central Power & Light Co has named **Williams C. Cunningham** to the new post of executive assistant.

Maine Public Service Co recently named **George W. Clark** assistant superintendent-transmission and distribution dept . . . **Herman J. Riechers** is new Ogallala district manager for Consumers Public Power District.

B. C. Electric Co's **William C. Mearns** has been elevated to vice president in charge of Vancouver Island operations, succeeding **Earnest Arnott,** retired.

Recently elected as officers of Maryland Utilities Assn were Potomac Edison Co's **Robert C. Carder** as president; Baltimore Gas & Electric Co's **Austin E. Penn,** first vice president; and **Robert L. Smith,** formerly with Potomac Ed, secretary. Directors are Conowingo Power Co's **J. Frank Blake, Jr;** BG&E's **Charles P. Crane;** and Eastern Shore Public Service Co's **William S. Moore.**

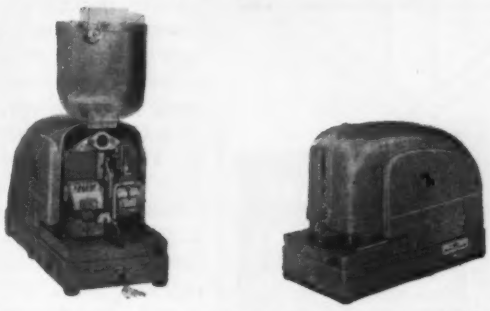
The newly created post of operating superintendent of New York State Electric & Gas Corp has been assigned to **Albert D. Tuttle,** former operating superintendent of the Western Division. He will assume the new post early this summer.

Tom D. Fulford has retired as vice president-sales for Virginia Electric & Power Co . . . New VEPCO sales executives are **Walter J. Matthews,** who becomes general sales manager; **W. Perry Johnson,** assistant manager-sales contracts, system sales dept; **Alfred G. Wilson,** Richmond district sales supervisor; and **David W. Poole,** assistant to the general sales manager of the company.

George A. Spencer is new general superintendent of Detroit Edison Co's stores dept . . . Inland Empire Waterways Assn has designated **Brig General Louis H. Foote** as engineering and economic consultant.

The NEW American 225 Receiptor

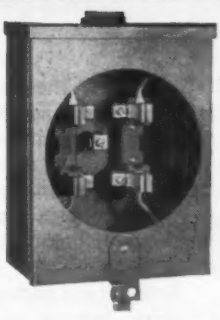
especially designed for stub-type bills
used with punch-card tabulating systems



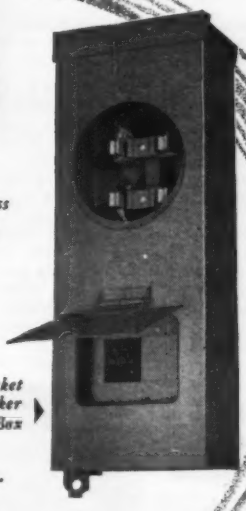
The new American 225 is great news for electric utility and other companies using postcard-type bills in connection with punch-card tabulating systems. In a fraction of a second, automatically, it performs three key operations which have never before been successfully combined. It perforates the customer's part of the bill, marking it unalterably, ineradicably, with the date, location number, company initials and teller's number. On the accounting stub it prints the date and teller number without the slightest disturbance of code perforations. And—all in one instantaneous operation—it severs the two portions of the bill, cleanly. American Perforator products have been leaders in their field for almost half a century. Write for facts.

HELLER ROBERTS
Manufacturing Corporation
AMERICAN PERFORATOR DIVISION
700 Jamaica Ave., Brooklyn 8, N. Y.

Look to Superior for SOCKET EQUIPMENT



Ringless Meter Socket



Socket Breaker Box

Superior also offers a complete line of:
Test Switches — Enclosures
Test Blocks — Test Tables

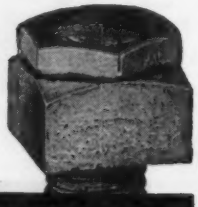
SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Catalog 55 offers complete information on features, services, types and sizes. Write to:

• Eliminate checking and re-tightening
• Eliminate radio interference due to loose hardware

Every bolt - and - nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied — require little space—may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

The PALNUT Co.
51 Glen Road
Mountainside
N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

The Industries Group of Allis-Chalmers Manufacturing Co has named **A. P. Bowman** manager of the Milwaukee district office and **James I. Onarheim** to the new post of manager of utility sales, Milwaukee district . . . **Richard R. Goetz** is appointed service manager—Midwest region, with headquarters in St. Louis, Mo. He succeeds **R. L. Stroope,** who returns to Allis-Chalmers' West Allis Works . . . The new manager of the general industrial sales section of company's Cincinnati district office is **Richard L. McDermott** . . . **Carl W. Bernhard** is named assistant to the chief engineer, steam turbine department.

Chase Brass & Copper Co has made **Albert T. Both** assistant vice president-operations. **Howard C. Walters** will succeed Both as Cleveland works manager.

Donald G. DeBolt has been named product manager, power-switching equipment, of the A. B. Chance Co.

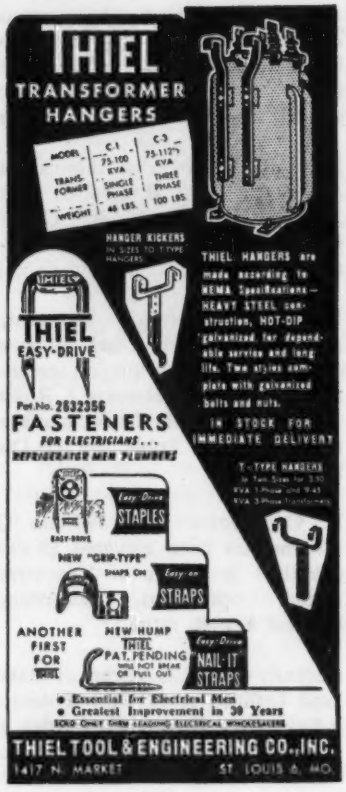
Raymond E. LaPlante has been appointed manager of West Coast sales for the Brown Co. . . . Cornell-Dubilier Electric Corp has named **Theodore Rosser** general manager of the Chicago office.

At General Electric Co, **Carl A. Salmonsen** has been named general manager of the new air conditioning dept . . . **Walter A. Ruderfer** has been designated manager of marketing administration in GE's insulating materials operation.

Westinghouse Electric Corp's Buffalo manufacturing and repair plant has as its new manager **E. J. Kehm.**

Dr Robert M. Bowie has been appointed vice president of Sylvania Research Laboratories, a division of Sylvania Electric Products, Inc . . . Sylvania has named **Raymond P. Connors** director of national accounts for Lighting Products Div.

John K. Campbell is new manager-government sales of Philco Corp's Government and Industrial Division . . . **Frank A. Sullivan** has been named general sales manager of industrial and commercial lighting for both Wheeler Reflector Co and Fullerton Mfg Corp, newly combined divisions of Franklin Research Corp.



WINCO
PORTABLE ELECTRIC POWER
WITH
Automatic CONSERV-er
IDLING CONTROL
EXTENDS ENGINE LIFE
REDUCES FUEL CONSUMPTION
LOWERS MAINTENANCE COST
WINCO MODEL 2058145 2D-1M 2500 watts, direct drive, 115 volts, 60 cycle A. C. Lightweight. Carrying Cradle optional
After starting, plant automatically idles, until load of 75 watts or more is applied. Automatic CONSERV-er brings engine to full power when tool is turned on, reduces engine to idling speed when tool is turned off—all automatically. Get all the facts on this Profit-Building Winco feature.
FULL LINE OF PORTABLE AND STAND-BY AC & DC PLANTS. 300 WATTS TO 10 KW
WRITE DEPT. EW-58
WINCHARGER CORPORATION
SIOUX CITY, IOWA
Subsidiary of Zenith Radio Corporation

At Worthington Corp, **David S. Gibson** has been elected vice president-purchasing . . . **Frank W. Jenks,** president, will become chief executive officer of International Harvester Co when **John L. McCaffrey** retires in May.

J. Elmer Forrest has advanced to general sales manager-mechanical products for Diamond Power Specialty Corp . . . Olin Mathieson Chemical Corp has appointed **John M. Welch** director of field sales for Olin Aluminum . . . **Joseph J. Graves** has joined Square D Co's public relations staff.

L. Stewart Mims has joined Atomics International, a division of North American Aviation, Inc, as group leader of preliminary engineering . . . **George J. Crowdes** has been appointed chief controls engineer of Assembly Products, Inc . . . Anaconda Wire & Cable Co has named **Walter J. Plate** manager of accessories division.

Herbert M. Appleton has been appointed assistant to George N. Proctor, vice president and general manager of the Permutit Co.

Corning Glass Works has appointed **James M. Brown** director of the new management development division; **Benjamin S. Peirson** becomes director of the public affairs division, and **Thomas A. Kirkland** was made director, marketing division.

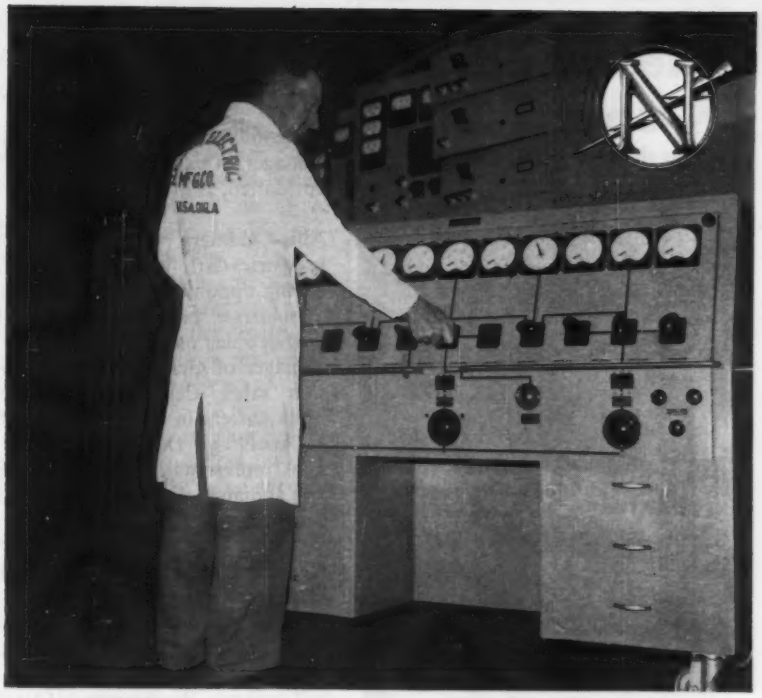
Fairbanks, Morse & Co has appointed **Charles F. Doepke** manager of public relations and advertising. . . . **R. D. Paine** has been named assistant secretary and assistant comptroller of Graybar Electric Co.

Thor Power Tool Co has appointed **William F. Fowler, Jr,** general manager, to the additional position of manager of Thor branch operations.

OBITUARY

T. C. Buchanan, 62, former member and chairman of Federal Power Commission, died at his Beaver, Pa., home recently of a heart ailment.

John P. Coghlan, 81, retired executive of Pacific Gas & Electric Co, died recently in San Francisco.



NELSON SWITCHBOARD TESTING ASSURES PERFECT OPERATION

Nelson makes certain at the factory that your switchboards and switchgear will work right. This quality control is now possible because the . . .

NEW NELSON SWITCHBOARD TESTER DUPLICATES FIELD OPERATING CONDITIONS

Developed by Nelson to test metering and relaying circuits of completed switchgear before shipment, this device tests potential and current circuits.

The performance of the switchboard is accurately measured. Gone is the guesswork of the old-fashioned continuity tests that showed only whether or not the switchgear was wired as shown on the wiring diagram.

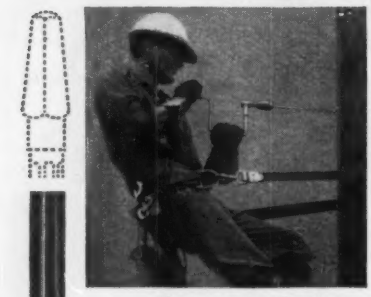
This test gives both Nelson and the customer the satisfaction of KNOWING that the equipment is *right* as it leaves Nelson's plant, and is going to function in the field when properly installed.

a major source of electrical control equipment for industry

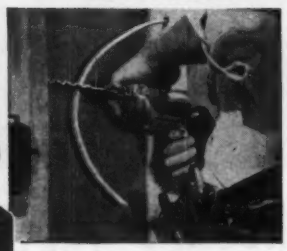
NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

New adapter shank bit

fits either hand brace or power drill



Taper square shank fits hand braces



Cut off taper and use "hex" shank in both power drills and hand braces

Cut your wood bit inventory by 50%

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers

Wilmington, Ohio

SALES ASSIGNMENTS

COMPANY STAFFS

Anaconda Wire & Cable Co's new manager of export sales is Ross A. de Matteo, II.

Allis-Chalmers Manufacturing Co's Industries Group has made the following appointments: Carl R. Hall to manager of the Rockford (Ill.) district sales office; R. J. Dineen to manager of General Products Division sales, Central Region, with headquarters in Cleveland; and Jon F. Abels and Donald J. Powers to sales representatives of the Wichita and Indianapolis district offices, respectively.

General Electric Co has designated Michael L. Chater as area representative for the metallurgical products dept's magnetic materials section. As West Coast representative, he will cover Washington, Oregon, California, and Arizona.

Graybar Electric Co has named two new district appliance sales managers. They are W. H. Mayben, who was assigned the San Francisco area; and E. W. Bonnet, who will handle the Los Angeles area effective June 1.

Pittsburgh Reflector Co recently appointed James F. Ligon as sales representative for the Cincinnati area, which is comprised of Ohio, West Virginia, and Kentucky.

Porcelain Products, Inc, has promoted Allan G. Smith, Jr, to the new post of zone sales manager of its Carey Division. He will be responsible for all sales activities in Wisconsin, Michigan, Minnesota, North Dakota, South Dakota, Nebraska, Iowa, northern Illinois, and northern Indiana.

REPRESENTATIVES

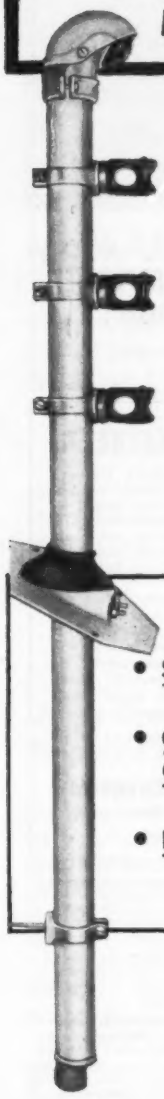
Automatic Switch Co has appointed Frank D. Riggio, Inc, as authorized stocking distributors of Asco Solenoid valves in the Rutherford, N. J. vicinity.

Philco Corp's new distributor in the Philadelphia area is John M. Otter Co. Otter is former executive vice president of Philco.

Haley's
CEDAR POLES
•
FIR CROSS ARMS
Pentachlorophenal Treated—protected against decay, moisture and insect damage, and give long service life. Thoroughly tested and approved by leading public utilities as standard construction.
R. G. HALEY & CO.
Spitzer Bldg., Toledo 4, Ohio
2 YARDS
MINNEAPOLIS
MINNESOTA
FINDLAY, OHIO
R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO

INDIANA STEEL & WIRE CO.
Crapo Galvanizing
MUNCIE, IND.
Signs along the lines of Crapo GALVANIZED STEEL STRAND PERFORMANCE
For dependable performance . . . insist upon Crapo Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes Crapo Steel Strand first choice for guys, messenger and overhead ground wire.
The famous Crapo galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.
• Low maintenance cost
• Laboratory tested and controlled quality
• Meets highest quality standards
• A size and grade for all practical needs
• Contact your Crapo Jobber Today!
INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

Be Sure!
INSTALL
PORCELAIN PRODUCTS
"Sure Seal"
Mast Kits



- STRONGER
- COMPLETE IN ONE PACKAGE
- ECONOMICAL

Send for NEW Mast Kit Brochure

64 years
Electrical Porcelain Since 1894.
PP INC.
Porcelain Products, Inc.
CAREY, OHIO

Computer-Control System Set for Commonwealth Edison Co

Commonwealth Edison Co has placed orders for an economic dispatch computer and controls system to distribute production among its 12 generating stations more economically and efficiently.

The installation will cost $750,000. Company officials said that savings produced by the set-up will pay for the job within a few years. It will take about two years to complete the project.

Components will be supplied by General Electric Co. This includes an analog computer to determine load factor, and a selsyn and servo system to regulate output of generators to meet exact demand.

The 12 stations house 55 turbine-generating units. The computer will be fed such information as the cost at which each machine produces electricity, amount of fuel required, cost on transporting it to the station involved, and transmission cost.

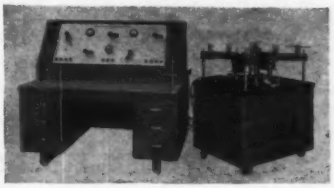
MP&L Slates Expansion

Mississippi Power & Light Co plans a $19,186,000 construction budget for 1958. Bulk of this expenditure will go into additional generating facilities at Rex Brown Steam Station where a 230,000-kw unit is being added at cost of $25 million. The company will spend over $13 million on the Rex Brown addition in 1958. Other expenditures for the year include $2.1 million for transmission and $3.3 million for distribution.

COATES Field Service, INC.
P. O. Box 1581 Okla. City
Thoroughly Specialized
RIGHT-OF-WAY ACQUISITION
From Title Search . . . To Damage Claims

DO YOU HAVE TROUBLE
getting sufficient current when testing
CURRENT TRANSFORMERS

• **THE STATES DESIGN** helps get more current at the *test point* . . . 10% and 2% ratio selector switches coupled with a small induction regulator provides a quick method for obtaining whatever current desired. Offers smooth and quick adjustment of current to full capacity of the Form C.T.T. outfits which are made in 1000, 2500, 5000, 6000 and 10,000 ampere capacities.



▶ **5000 AMPERE CAPACITY**
Control Table on left, Loading Transformer and Quick Contactor on right.
Contactor provides quick connection for standard transformer and transformer under test.

POLYPHASE METER TEST JACK
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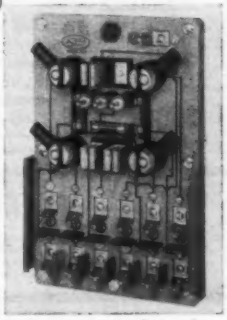
Will accommodate standard 3-element self-contained, 2-element, 3 ph., 4 wire Delta self-contained; 2½ element, 3 ph., 4 wire WYE self-contained; and 3-element 3 ph., 4 wire Delta self-contained



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Mock-Up Leads the Way on Vessel Trip

As bigger atomic power plants come off the drawing boards, utilities will face the transportation problems that confront builders of conventional plants. This is the case, at least, with movement of a 91-ton steel reactor vessel from Chattanooga, Tenn., to the Monroe, Mich., site of the Enrico Fermi Atomic Power Plant, 1,598 miles away. The journey involved a 928-mile barge haul on the Tennessee and Ohio rivers and a flat car journey of 670 miles. A pilot car, carrying a similarly sized mock-up of the vessel, led the way on the 15 mph max railroad leg. Atomic Power Development Associates, Inc, provided basic designs for the Enrico Fermi plant. Costs of the project are an estimated $37 million for the reactor plant, $14 million for the generating plant, and $20.5 million for research and development.

Utility Group Protests Proposed Radio Ruling

Objections to a proposed Federal Communications Commission rule on broad-band radio station operation have been drafted by the executive council of the National Committee for Utilities Radio. The council objects to the proposed time set at which a station authorized to operate with a ±15-kc maximum deviation must reduce this deviation.

The FCC's notice (Docket 12295) would require a station to reduce deviation so that station band width, plus an allowance for equipment frequency tolerance, does not exceed the band width specified in narrow-band technical standards.

NCUR concurs generally with other provisions of this notice.

After discussing channel splitting in the 47-48 mc part of the 42-50-mc band, the council said NCUR will issue a frequency assignment plan. This will help its regional frequency coordinators make recommendations for assignment of new split-channel frequencies. The council also will prepare information on the effect of split-channel rules and proposals on use of radio by NCUR members.

ACTION Program Outlined for Connecticut Managers

The full management corps of Connecticut Light & Power Co got an orientation recently on ACTION —the American Council to Improve Our Neighborhoods. It was the first time a power company had sponsored such a program for its entire management group, CL&P said.

Purpose of the session was to brief district and staff managers on procedures that could be used locally in an ACTION program. The background would enable a CP&L man to serve on a program committee.

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Readers Forum

More on Electric Autos

To the Editor:

Regarding your article on the electric auto (EW, March 10, p 42), the Bailey Co of Amesbury made a car driven by an Edison battery. The car was recently taken back from the Ford Museum and now is in Amesbury.

The Bailey Co now makes window channels for autos.

Also, recently I wrote to Dr Von Braun, director Developmnt Operations division, Army Ballistic Missile Agency, and asked him if a solar charged storage battery could be developed to drive missiles.

He answered, "Your suggestion that solar energy be used as a power source and applied to space vehicles is not only constructive but extremely realistic."

Also, recently I wrote to Dr Ernst Stuhlinger of the same agency and he answered, "In answer to your letter of Nov 28, yes, it is entirely possible to develop such a storage battery."

J. Richard Feeley
Insurance and Real Estate
25 Main Street
Amesbury, Mass

Congratulations on R/W

Congratulations are in order for the very fine meeting Electrical World organized for the electric utility right-of-way people. The subjects were timely, interesting, and instructive.

It is sometimes difficult to define the benefits received from these meetings, but one idea received could repay the time and expense of attending the meeting many times. I am sure every one left the meeting with greater knowledge and appreciation of the right-of-way problems of the electric utility industry, and derived more benefits from being there than perhaps they realize.

In my opinion the meeting was an outstanding success and I would heartily recommend that every effort be made to continue the good work.

C. W. Coates
Pacific Gas & Electric Co
245 Market St.
San Francisco 6, Calif.

Co-ops Did the Pushing

To the Editor:

We have read with interest Mr. E. A. Nickelsen's letter to Editor (EW, March 17, p 122). We feel that Mr. Nickelsen is a little confused about what has actually taken place as far as the extension policy of electric service through the rural area is concerned.

The policy here in Colorado, within two miles of the city of Denver, shows that the prospective consumer paid the entire cost of the lines required to furnish electric service, and the minimums ran all the way from $5.00 to $25.00 per month or even more. The construction costs could be applied to the bill over a five year period only on the electric service used over and above the set minimum. This meant that the consumer never did get a refund of construction costs. This policy was not changed in Colorado until after the REA's had many miles of line constructed.

We have attended many National meetings all over the entire United States and the reports were the same as that in Colorado. No where did the private utility go out and beg or high pressure anyone to take electric service, until after REA lines were built or being built (but to the contrary, they discouraged the building of lines for electric service in the rural areas). We do know that the private utilities did high pressure rural consumers only after the private utilities saw the competition in their back yards where the REA's were furnishing or about to furnish electric service in these rural areas. These REA's did more to boost the standard of living than any other one thing in the United States.

As to the Iowa story, our Directors have visited with many, many Iowa people and never did anyone over the past twenty years, verify Mr. E. A. Nickelsen's statement about the private utilitites willingness to serve the rural areas before REA was established.

John G. Kalcevic, Manager
Union Rural Electric Association, Inc.
Brighton, Colorado

Advertising Index

Air Preheater Corp. 28
Allis-Chalmers Mfg. Co. 8, 9, 42, 103
Aluminum Co. of America 84, 85
Amp Incorporated 87
American Brass Company 96
Bethlehem Steel Company 22
Blackburn Corp., Jasper 93
Brown Company 80
Chance Co., A. B. 81
Coates Field Service, Inc. 113
Colorado Fuel & Iron Corp., Wickwire Spencer Steel Div. 106
Delta-Star Electric Division, H. K. Porter Company, Inc. 75
Diamond Power Specialty Corp. 107
Directory of Engineers 114
Dowell Incorporated 10
du Pont de Nemours & Co. (Inc.) Elastomer Chemicals Dept. 27
Electric Service Works, Delta-Star Division, H. K. Porter Company, Inc. 75
Elliott Company 30, 31
Engineers, Directory of 114
Enjay Company, Inc. 91
G&W Electric Specialty Co., Inc. 79
General Electric Co. Apparatus Dept. ..... 2nd Cover, 59, 60, 61, 62, 63, 64, 66, 67, 68, 69, 71, 73
Graybar Electric Co., Inc. 7
Haley & Co., R. G. 112
Heller Roberts Mfg. Corp. 109
Holan Corp., J. H. 76, 77
I-T-E Circuit Breaker Co., Switchgear Div. 6
Indiana Steel & Wire Co., Inc. 112
Irwin Auger Bit Co. 112
Lapp Insulator Co., Inc. 32
Line Material Industries 15, 16, 17, 18, 19
Moloney Electric Co. ..... 4th Cover
Nelson Electric Mfg. Co. 111
Ohio Brass Co. 37, 38, 39
Okonite Co., The 4
Onan & Sons, Inc., D. W. 108
Palnut Company 110
Pennsylvania Transformer Div., McGraw-Edison Co. 34, 35
Pioneer Service & Engineering Co. 82
Porcelain Products, Inc. 113
Preformed Line Products Co. 20
Reliable Electric Co. ..... 3rd Cover
Richardson-Allen Corp. 105
Roebling's Sons Corp., John A. 29
Rome Cable Corp. 101
S&C Electric Co. 21
Sangamo Electric Co. 40, 41
Searchlight Section 114, 115
Simplex Wire & Cable Co. 33
States Company 113
Superior Switchboard & Devices Co. 109
Thiel Tool & Engineering Co., Inc. 110
Victor Insulators Div., I-T-E Circuit Breaker Co., Inc. 83
Wagner Electric Corp. 36
Westinghouse Electric Corp. 23, 24, 25, 26, 88, 89, 94, 95
Wincharger Corporation 110
PROFESSIONAL SERVICES 115

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 114
EQUIPMENT (Used or Surplus New) For Sale 114

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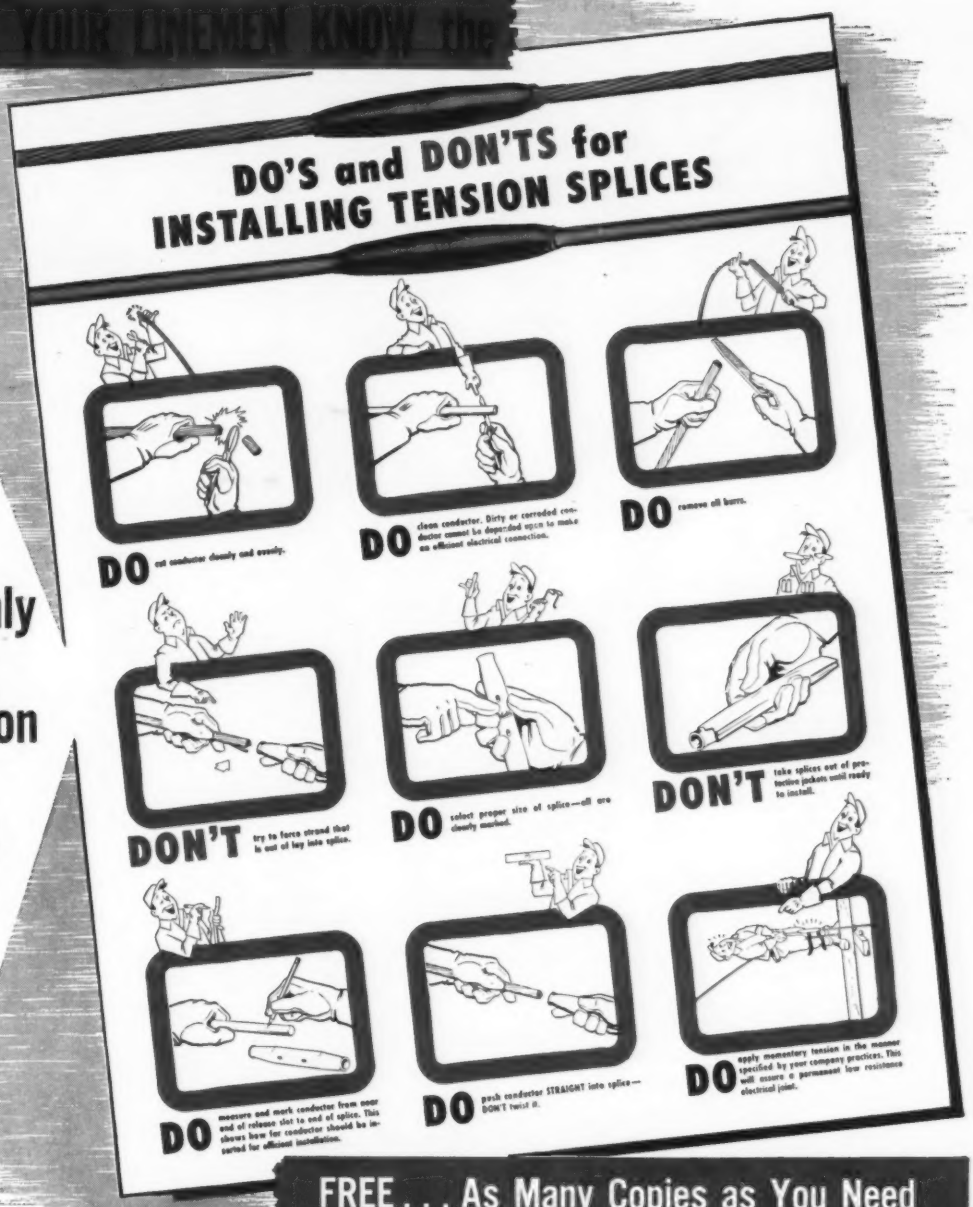
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DO cut conductor cleanly and evenly.
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DO remove all burrs.
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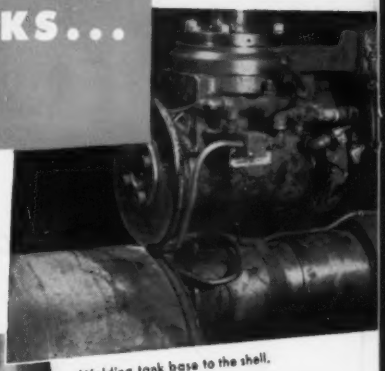
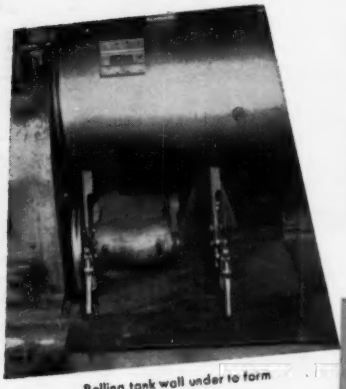
Seams being mash-resistance welded.

Seating base and forming top rim.



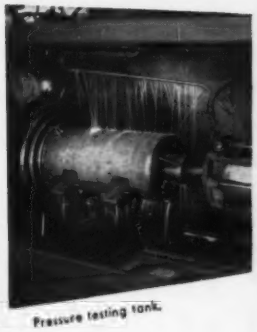
Welding tank base to the shell.



Rolling tank wall under to form triple thickness at base.

Automatic positioning resistance welder welding fins to tank.

Welding fixtures to tank wall.



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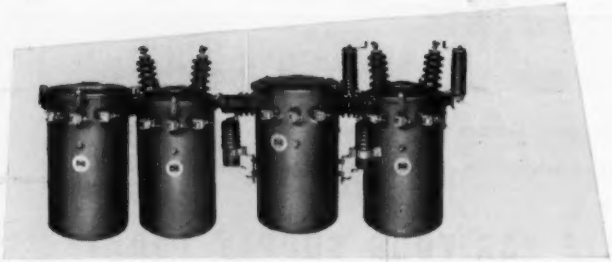

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